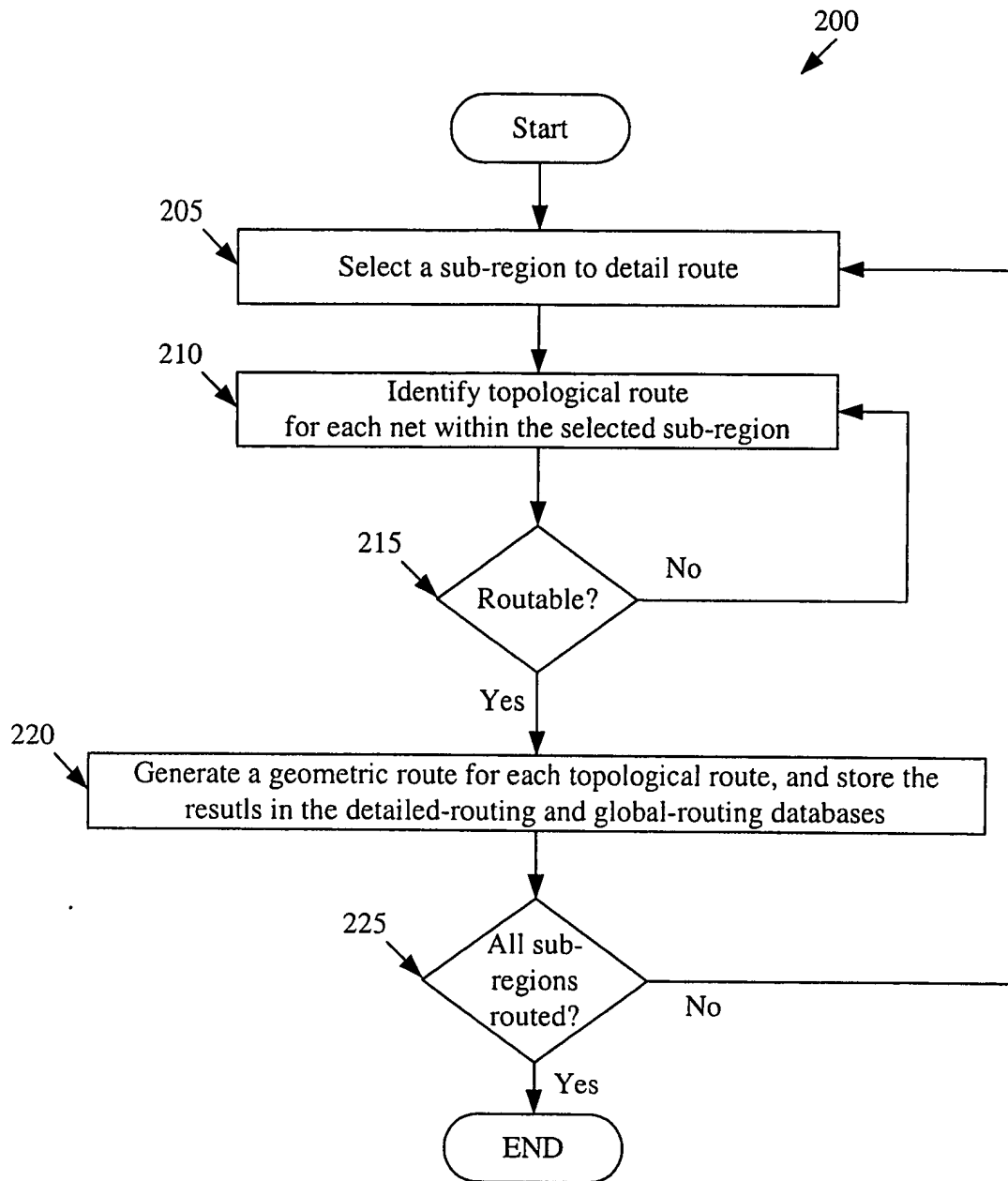


*Figure 1*



**Figure 2**

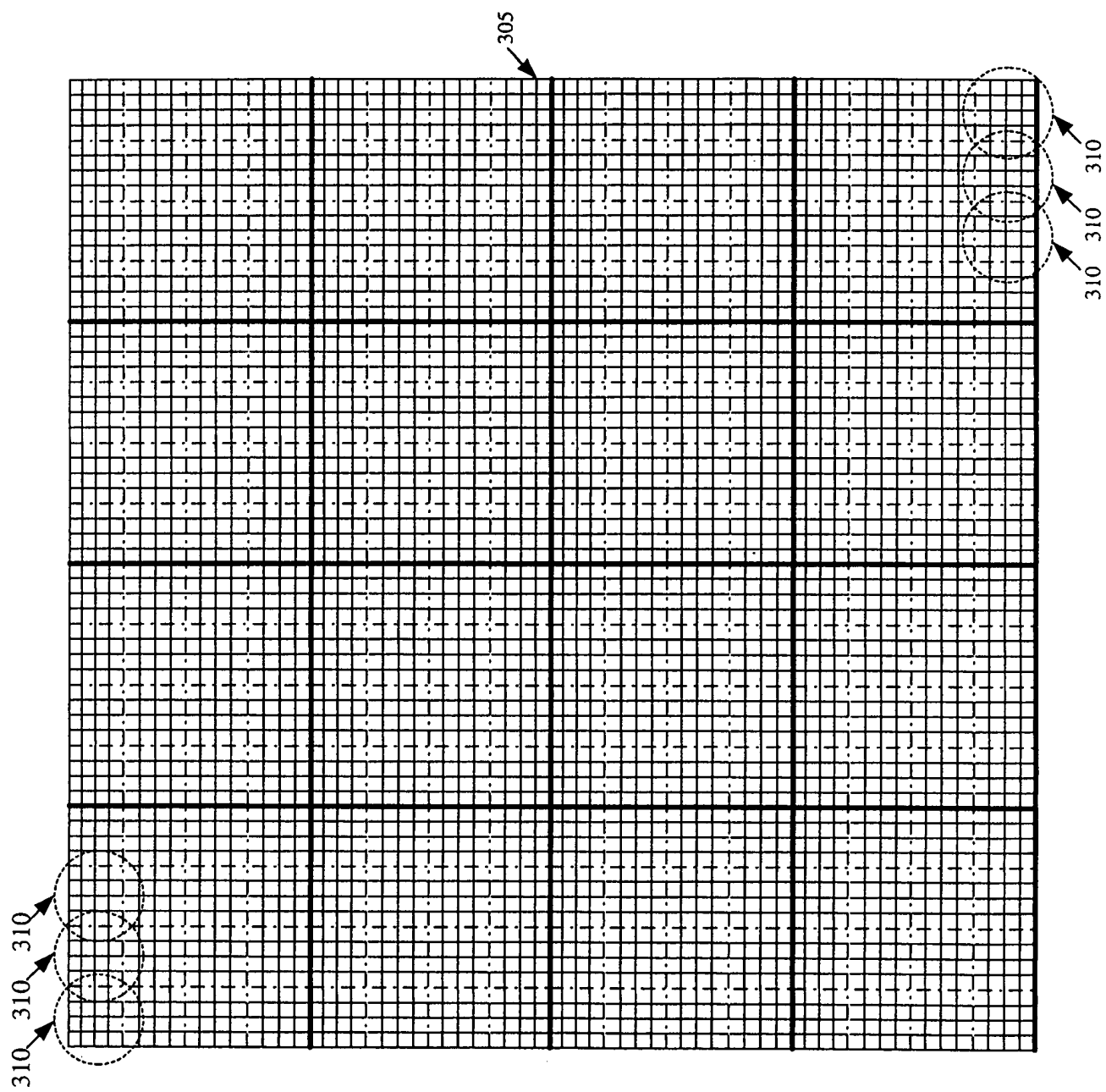
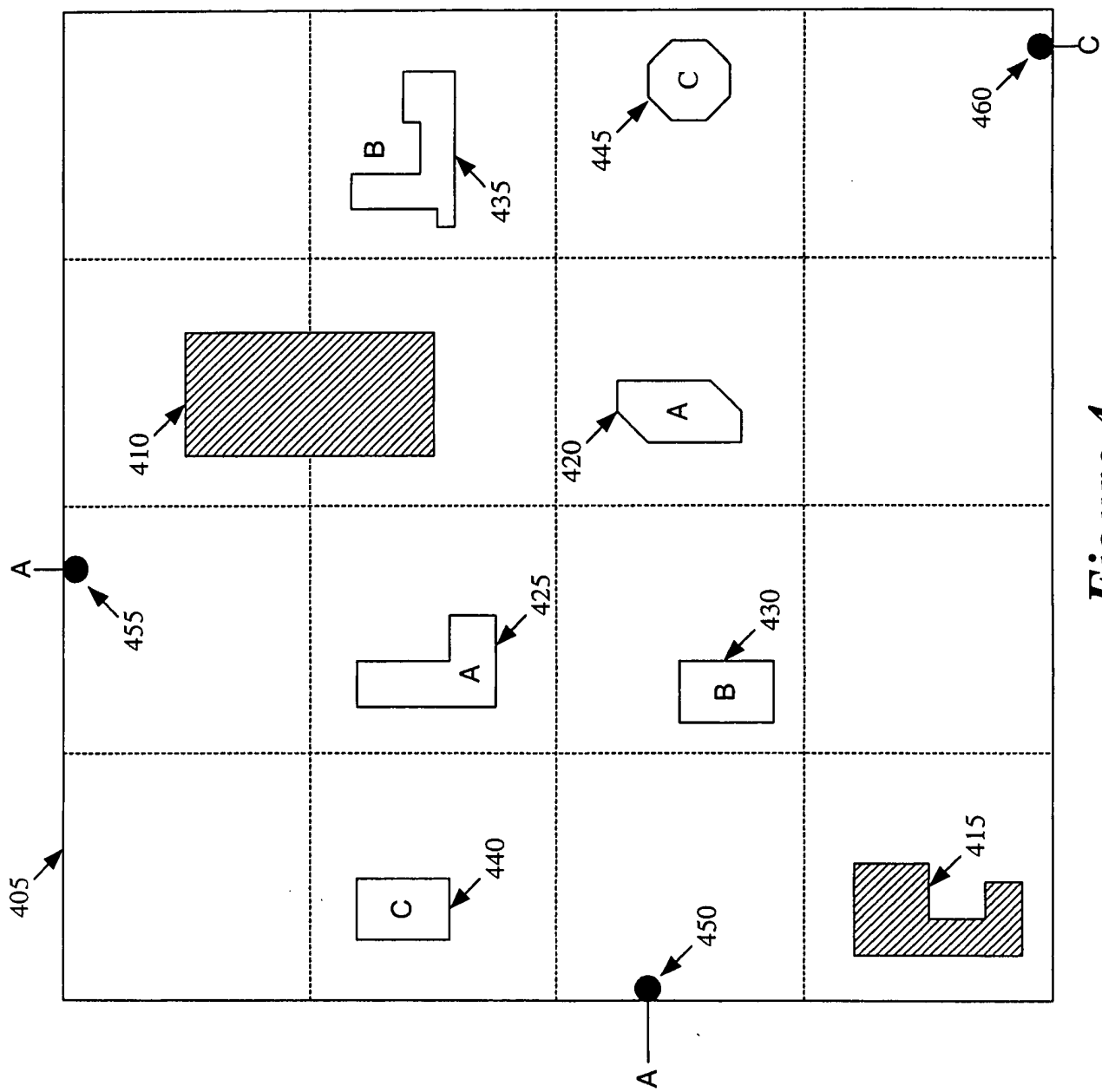
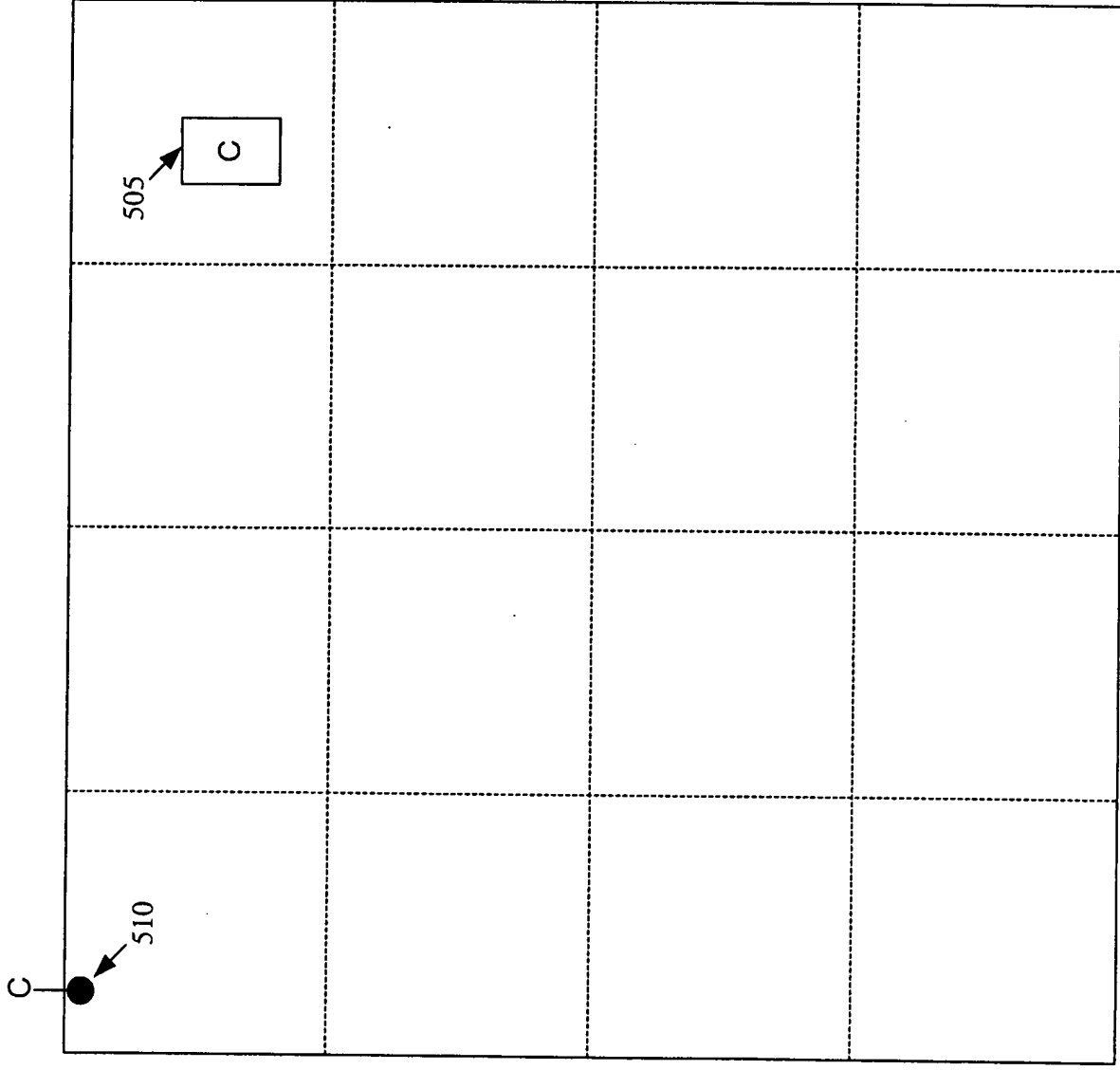


Figure 3



*Figure 4*



*Figure 5*

*Figure 6*

```
-List of Geometries
--Each Geometry including a sequence of points & layer assignment
-Bounding box of the region
-Array of layer properties
--Minimum wire size
--Minimum spacing
--Via sizes
--Cost/Unit
-Netlist specifying a number of nets
--Each net specifying a set of pins
--Each pin specifying a set of ports
--Each port specifying a set of geometries
```

*Figure 7*

```
-List of Geometries
--Each Geometry including a sequence of points & layer assignment
--List of connection nodes inside each pin geometry
-Bounding box of the region
-Array of layer properties
--Minimum wire size
--Minimum spacing
--Via sizes
--Cost/Unit
-Netlist specifying a number of nets
--Each net specifying a set of pins
--Each pin specifying a set of ports
--Each port specifying a set of geometries
-For each layer, a graph specifying
--Nodes
--Edges
--Faces
```

Face
<ul style="list-style-type: none"> <li>-Reference to 3 edges</li> <li>-Reference to 3 nodes</li> <li>-Up to two references for up to two face item</li> </ul>

800

Edge
<ul style="list-style-type: none"> <li>-Two references for up to two faces of the edge</li> <li>-Capacity</li> <li>-Flow</li> <li>-Constrained</li> <li>-Linked list of items on the edge starting with one of the edge's nodes and ending with its other node</li> </ul>

900

Figure 8

Figure 9

Node
<ul style="list-style-type: none"> <li>-Net Identifier</li> <li>-One or more planar-path references to adjacent topological items in the same planar path</li> <li>-A pair of via-path references to up and down topological via items</li> <li>-A references to list of edges connected to the node</li> <li>-For each edge, an edge reference to the next or previous topological item on the edge</li> <li>-A reference to the geometry of the node</li> <li>-Vertex number identifying the vertex of the geometry</li> <li>-Location of the node</li> </ul>

1000

*Figure 10*

Edge Item
<ul style="list-style-type: none"> <li>-Reference to its edge</li> <li>-Net Identifier</li> <li>-A pair of planar-path references to adjacent topological items in the same planar path</li> <li>-A pair of edge references to the next and previous topological item on the edge</li> </ul>

1100

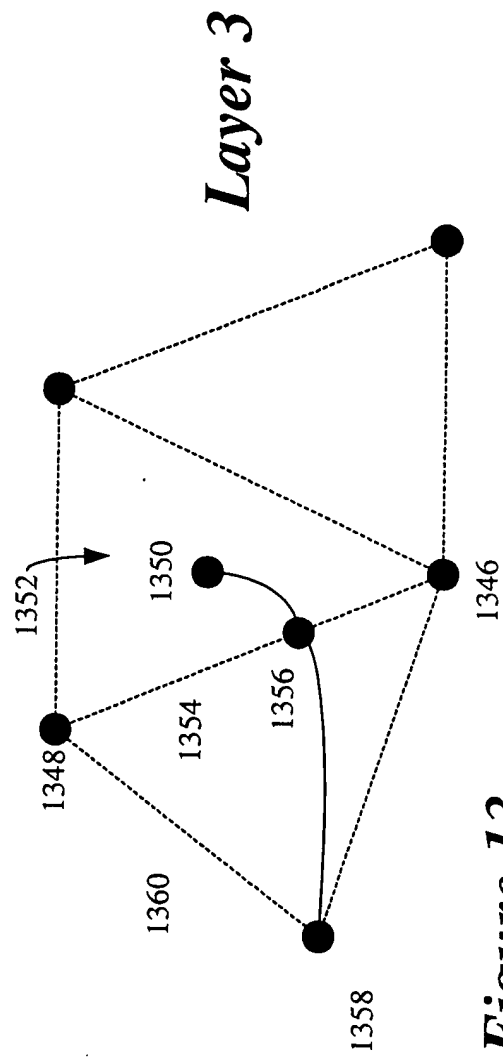
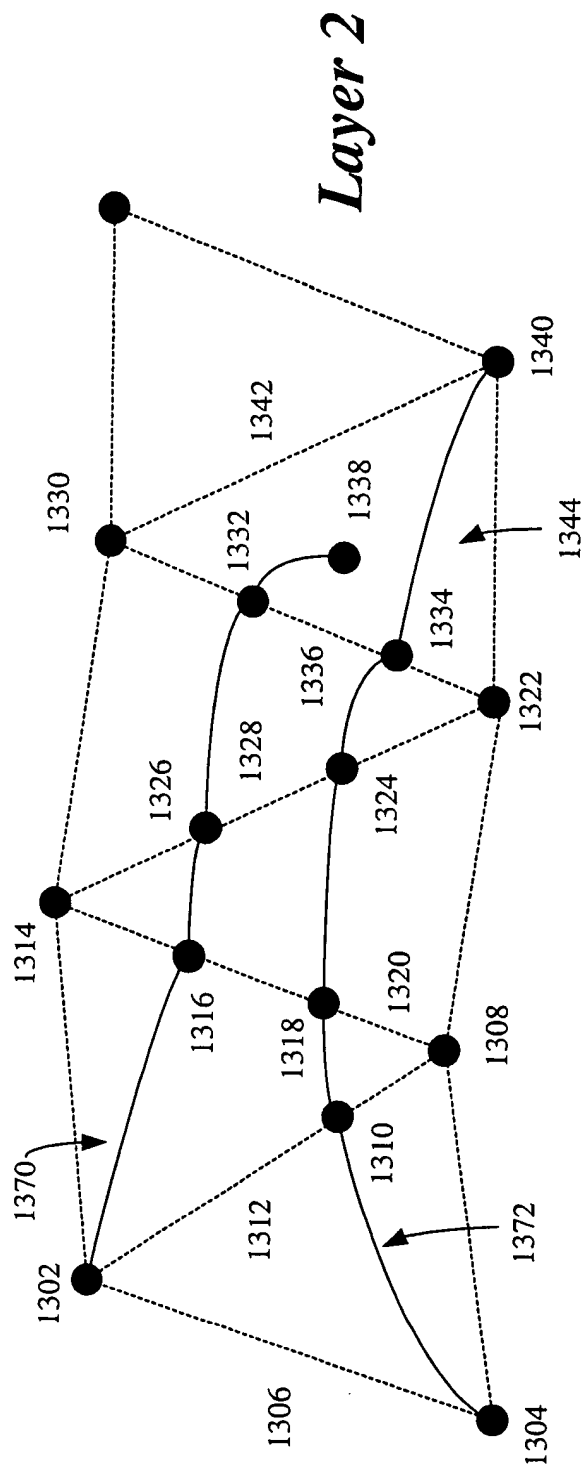
*Figure 11*

Face Item
<ul style="list-style-type: none"> <li>-Reference to its face</li> <li>-Net Identifier</li> <li>-Up to 3 planar-path references for adjacent topological items in the same planar path</li> <li>-A pair of via-path references for up and down topological via items</li> <li>-Bounding polygon that defines legal face item locations</li> <li>-Constraining Points and Distances</li> </ul>

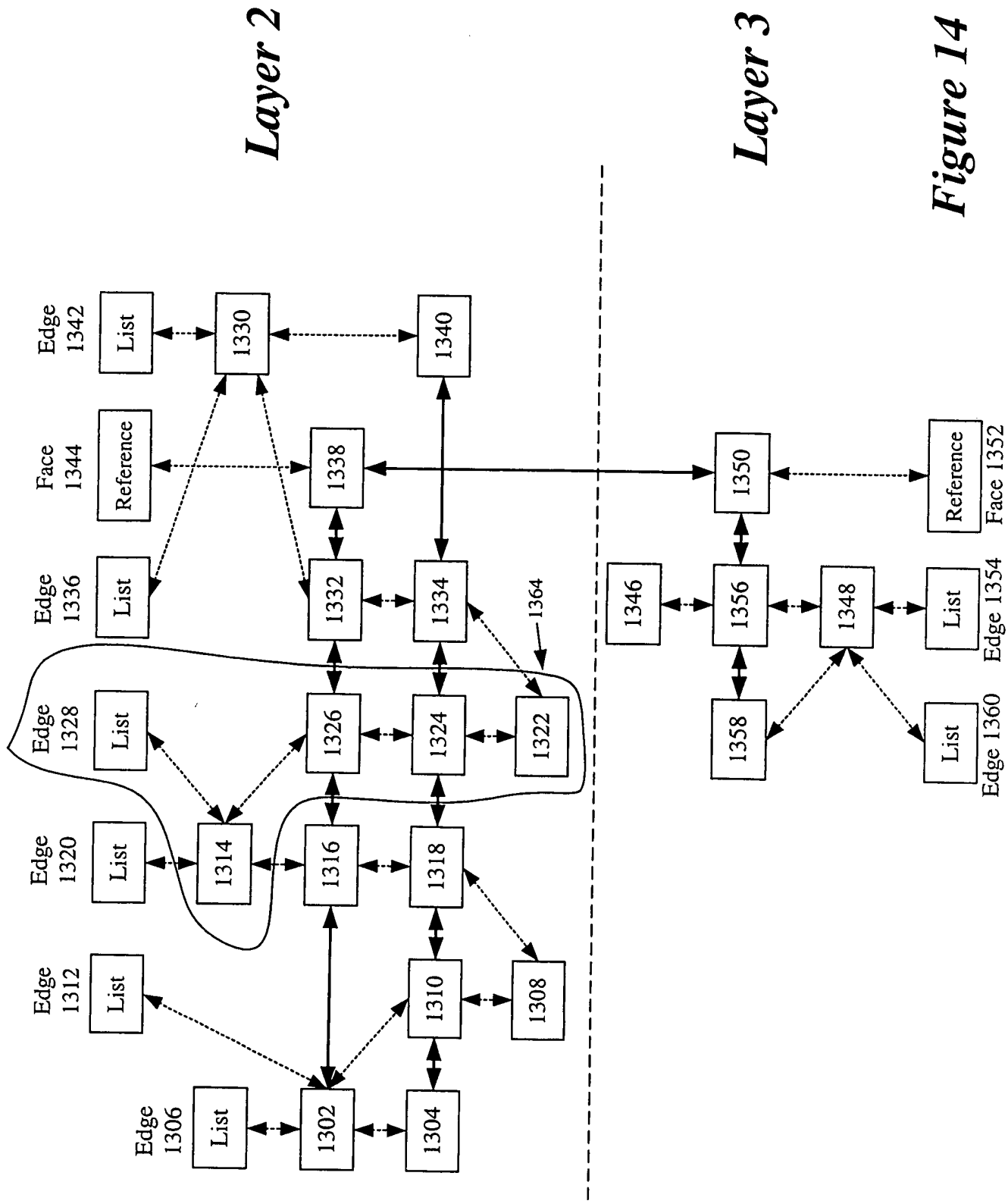
1200

*Figure 12*

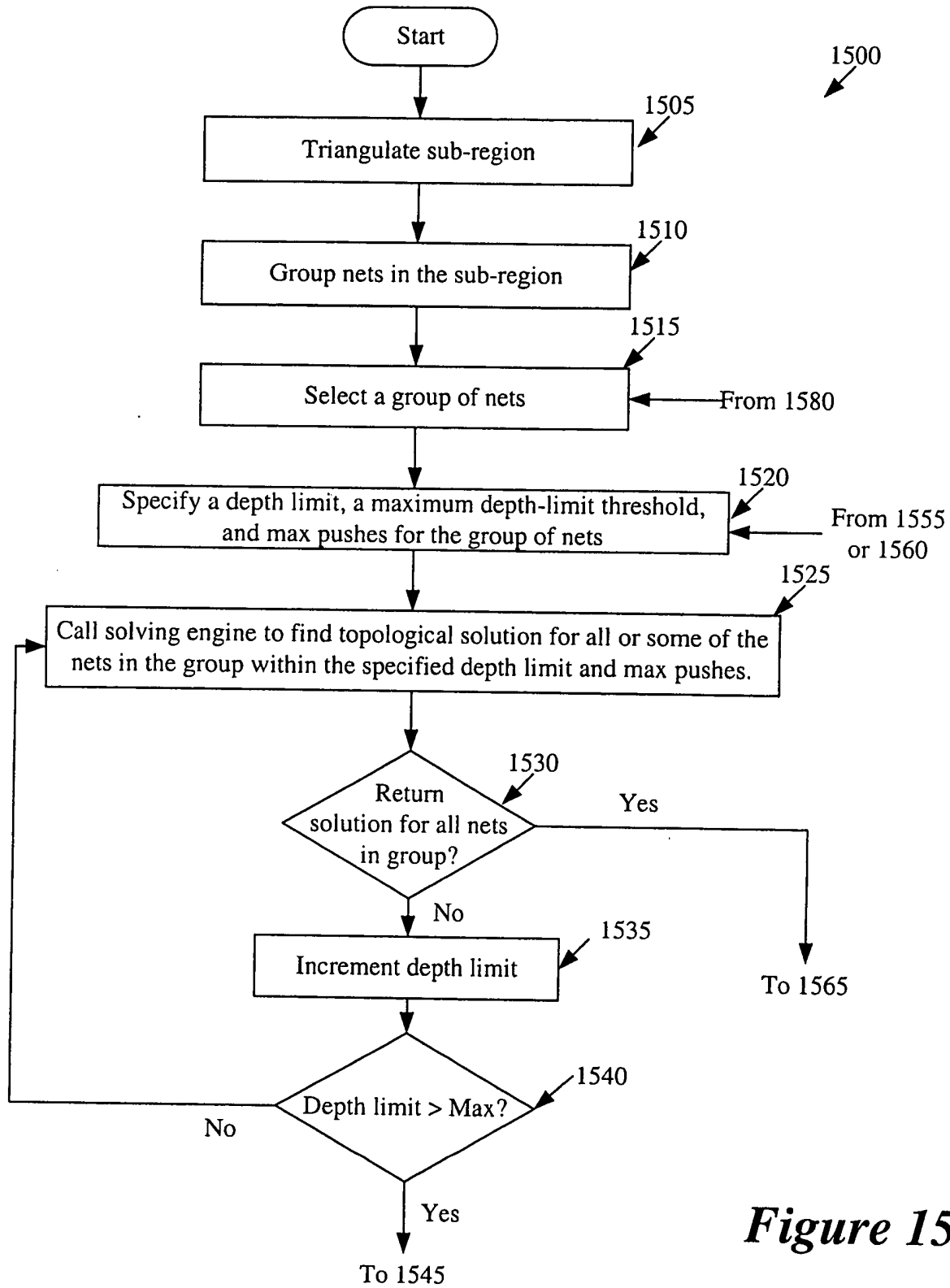




**Figure 13**

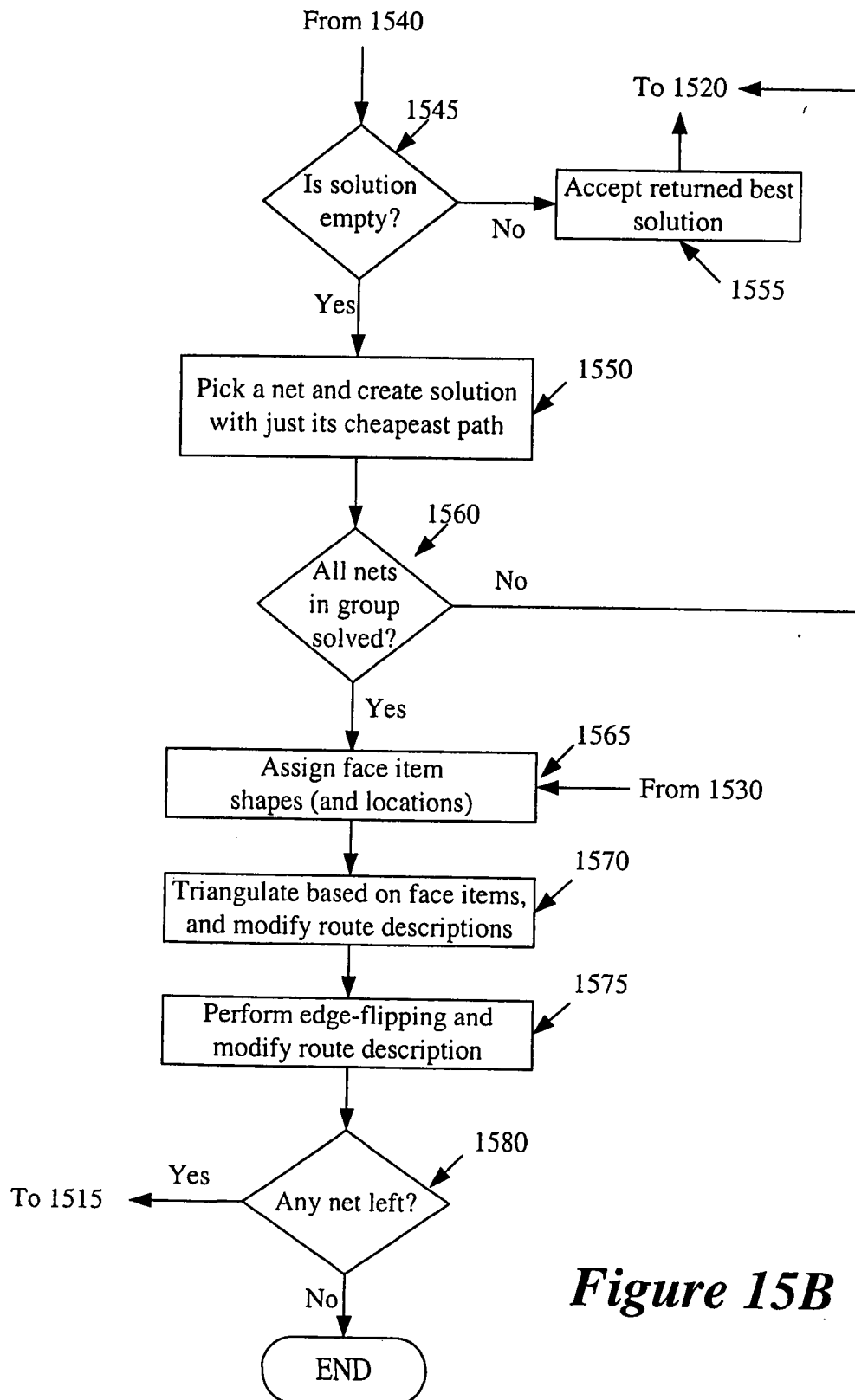


**Figure 14**

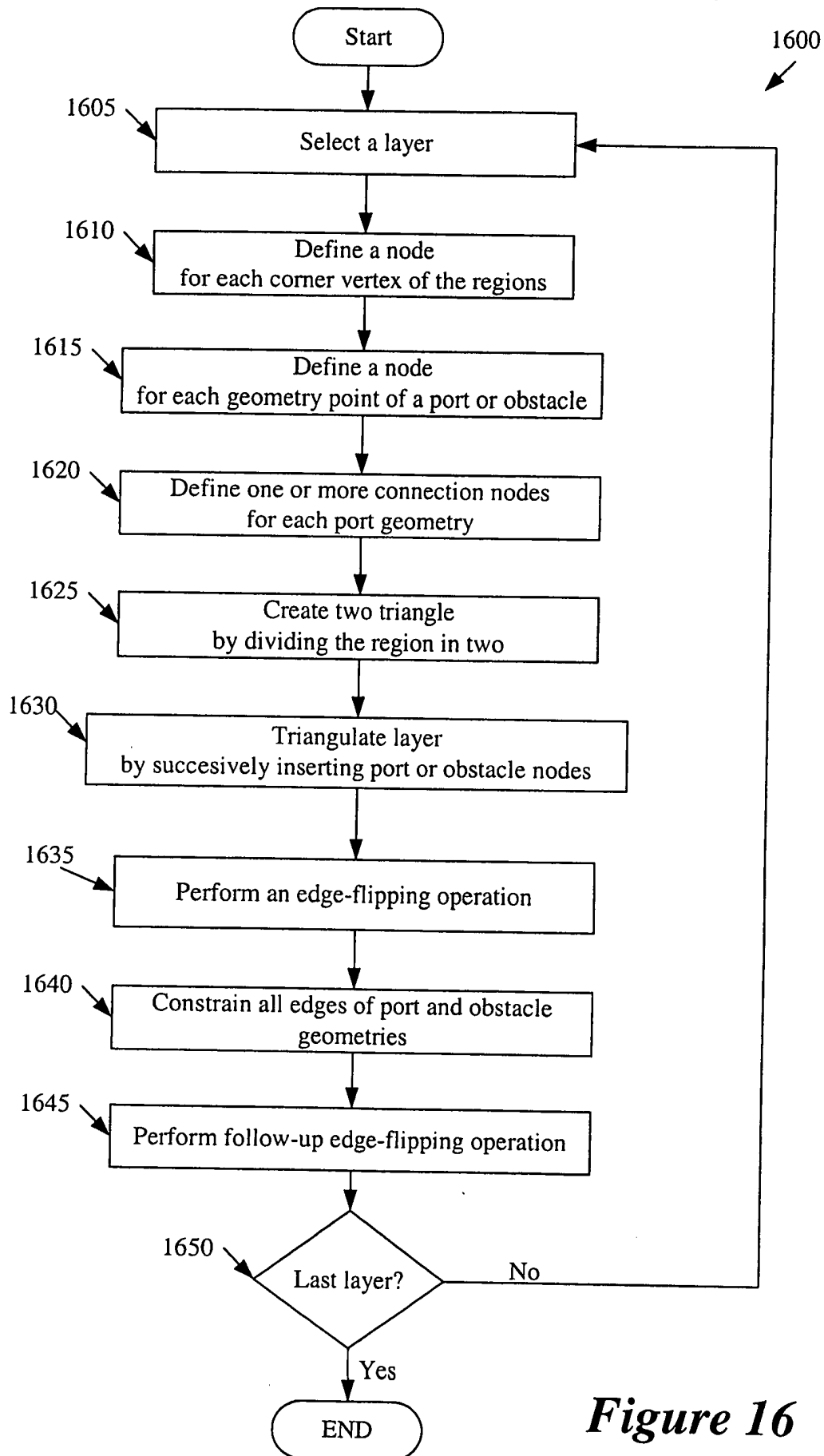


**Figure 15A**

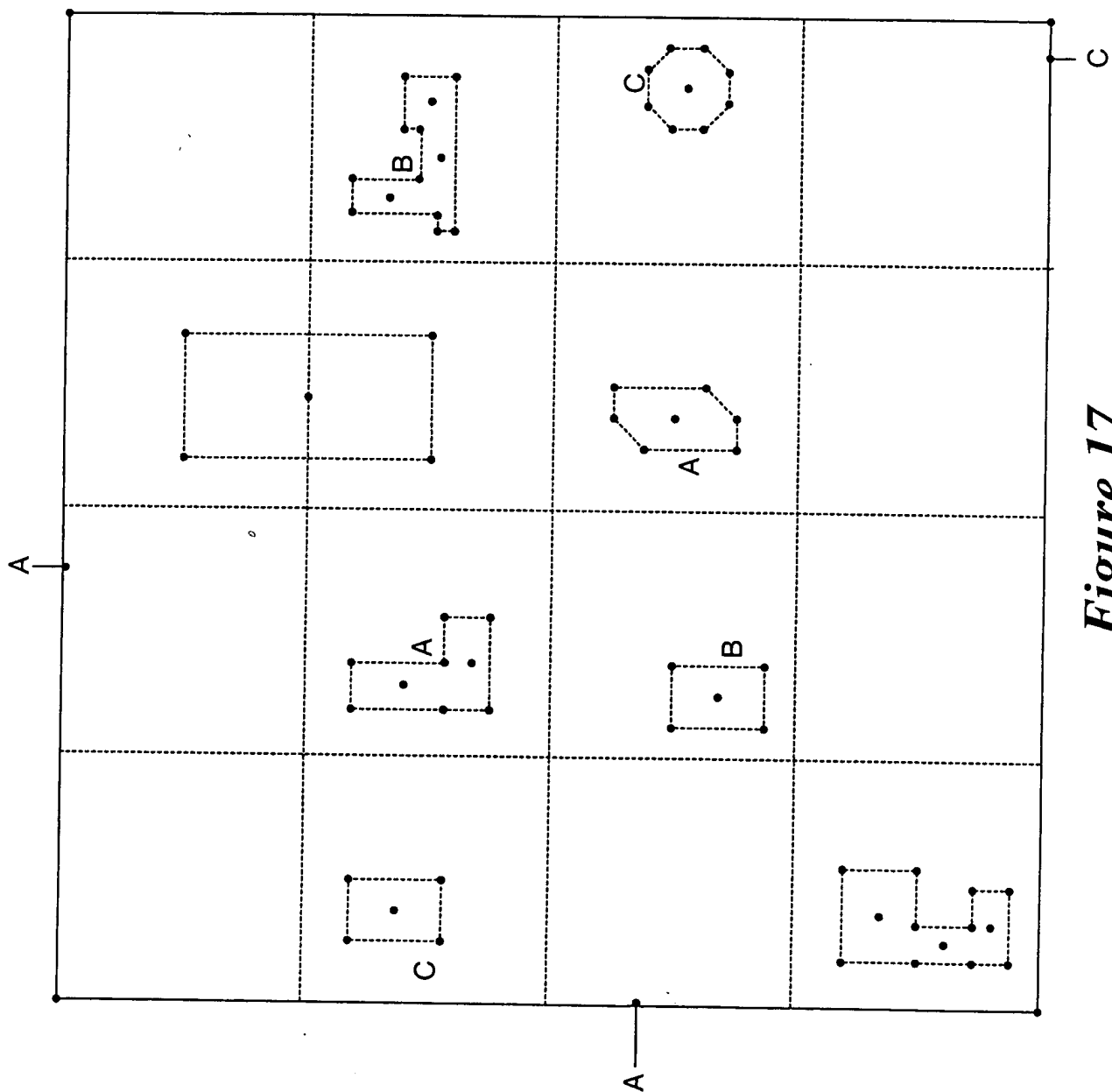
**Figure 15:** Figure 15A  
Figure 15B



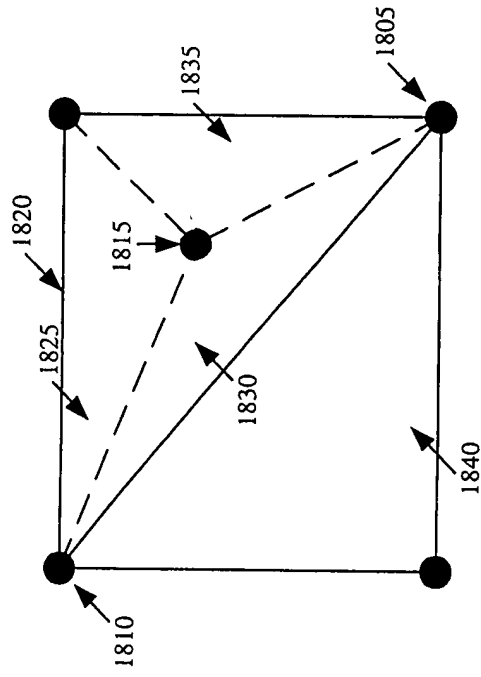
**Figure 15B**



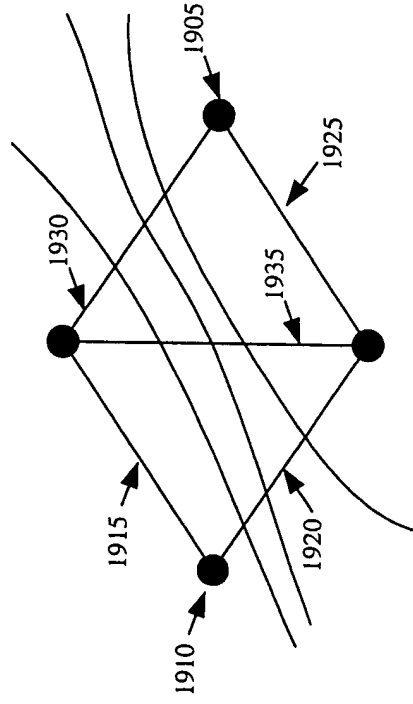
**Figure 16**



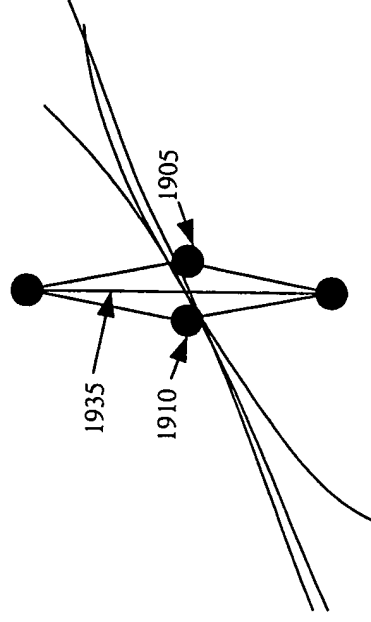
*Figure 17*



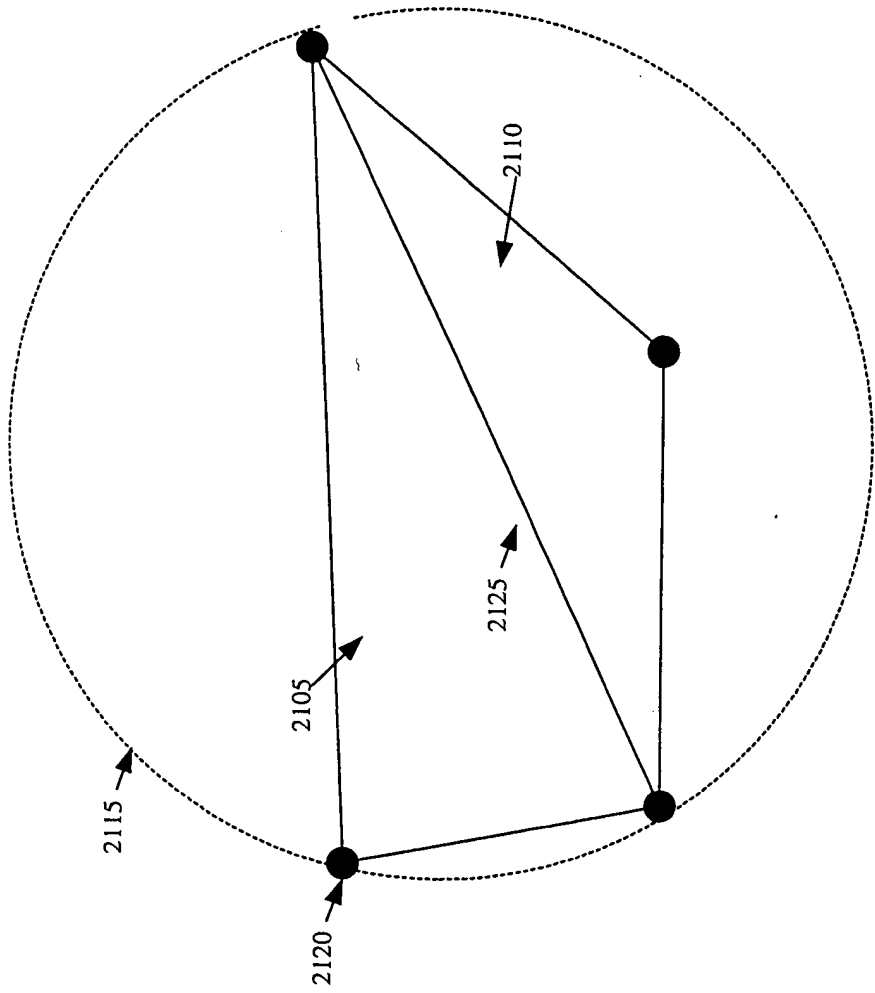
*Figure 18*



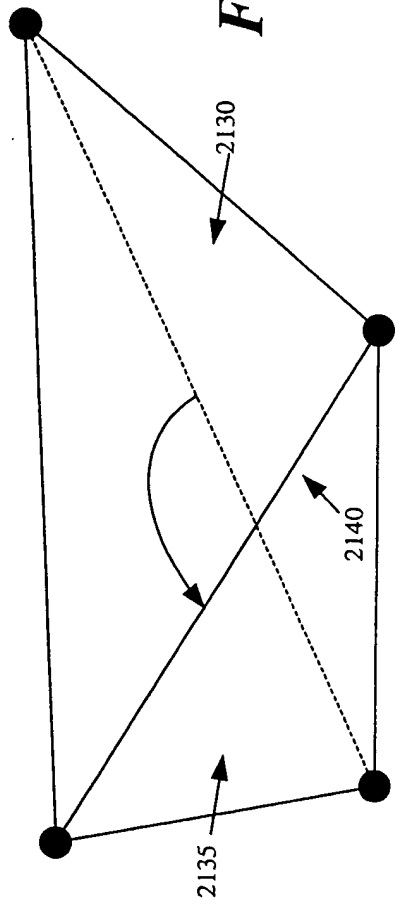
*Figure 19*



*Figure 20*

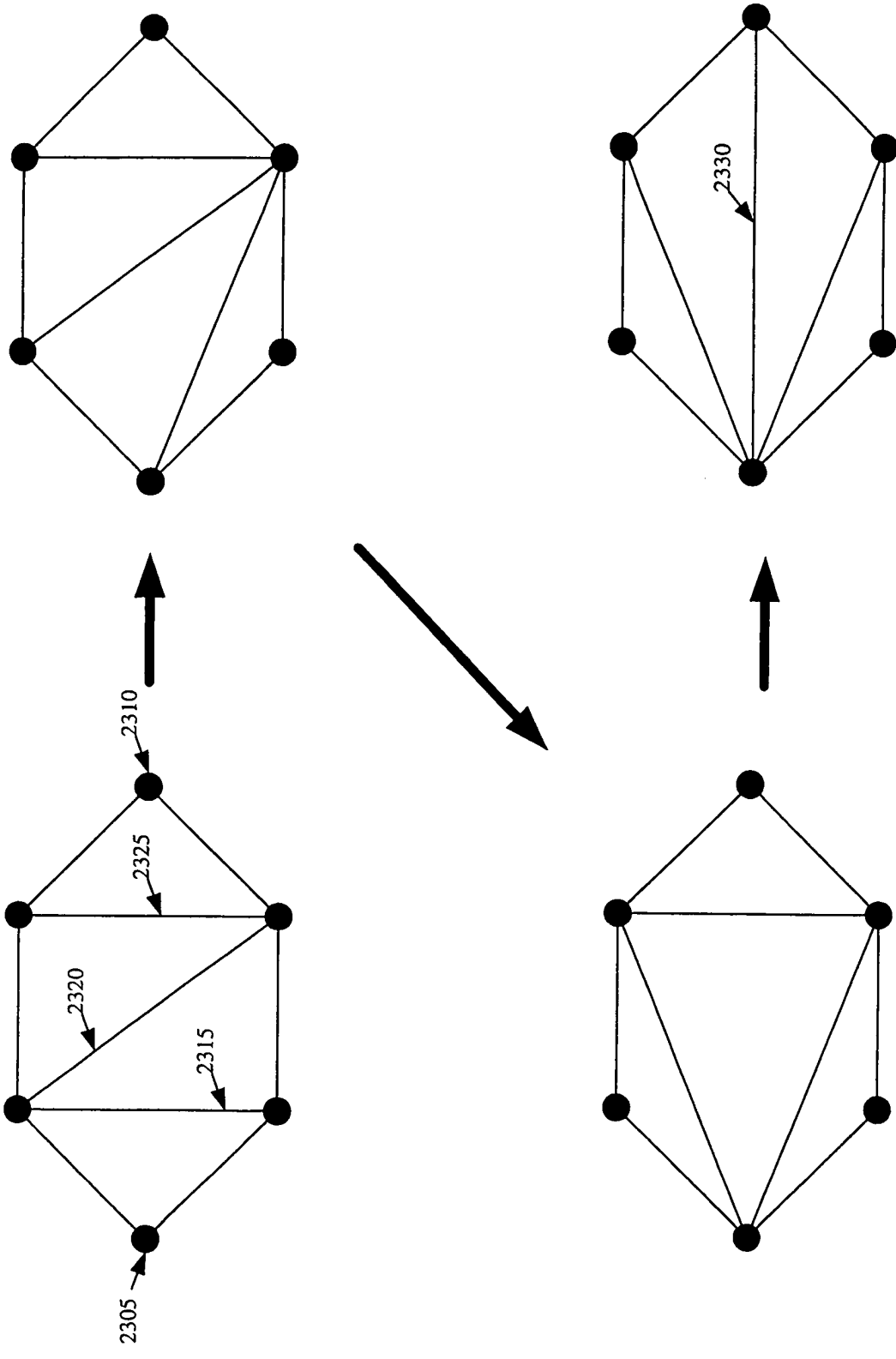


*Figure 21*

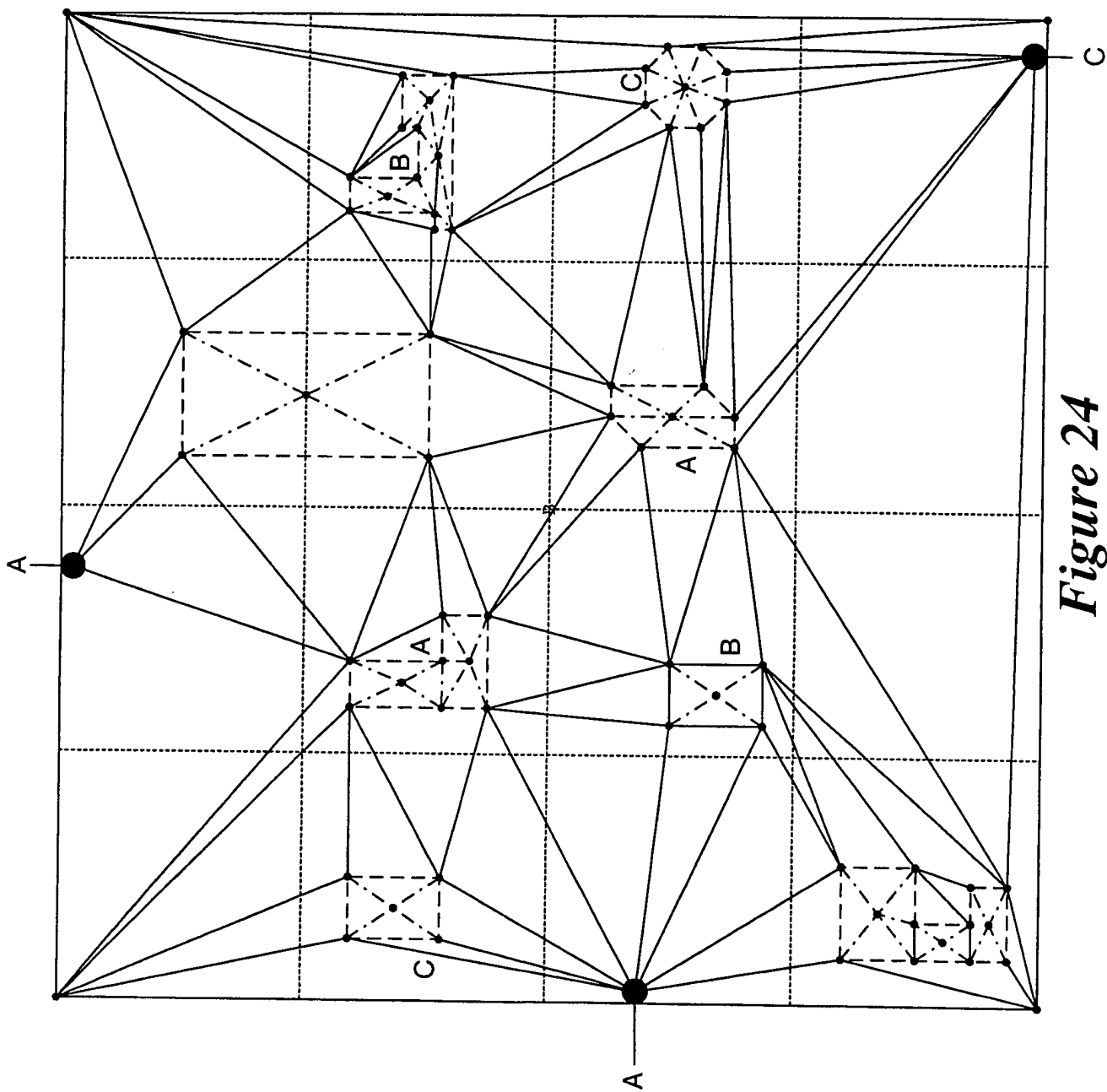


*Figure 22*

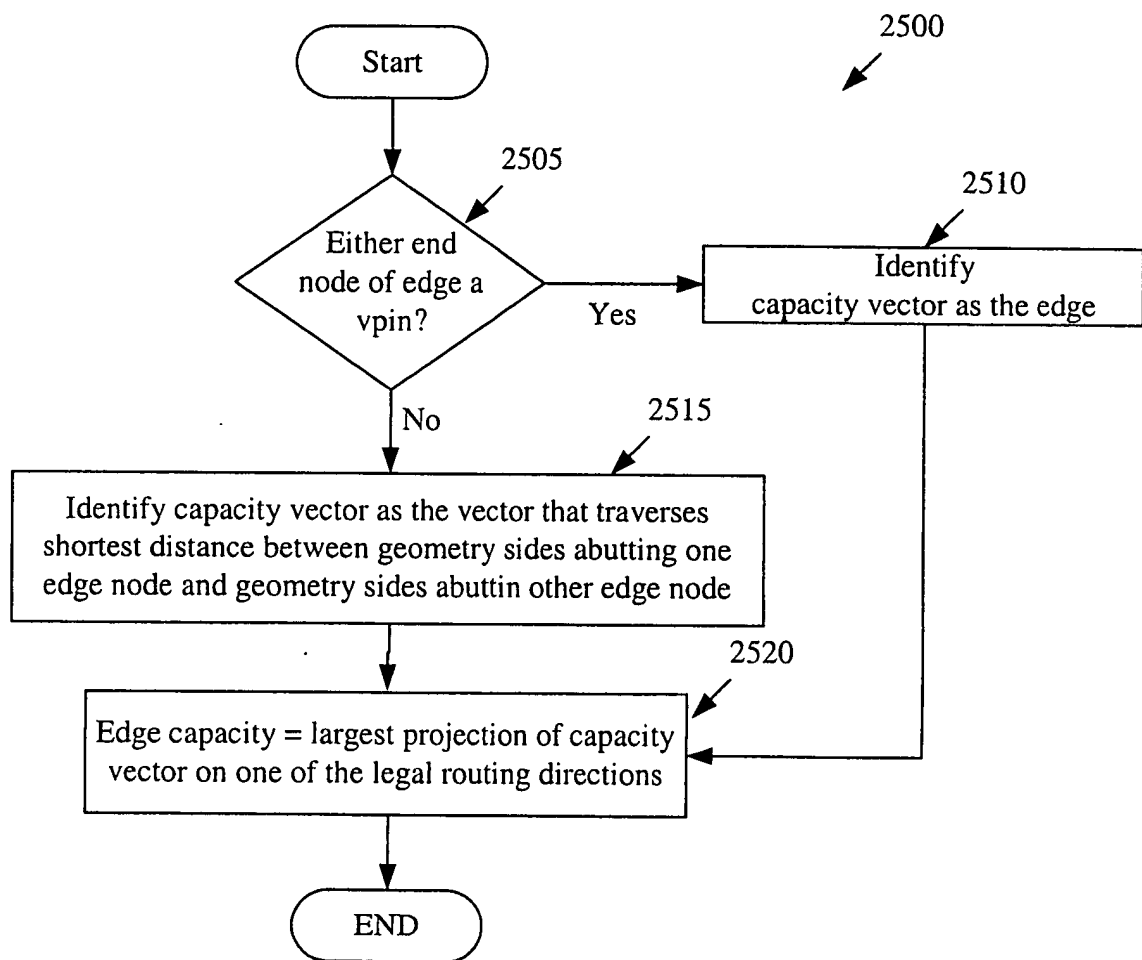




*Figure 23*



*Figure 24*



**Figure 25**

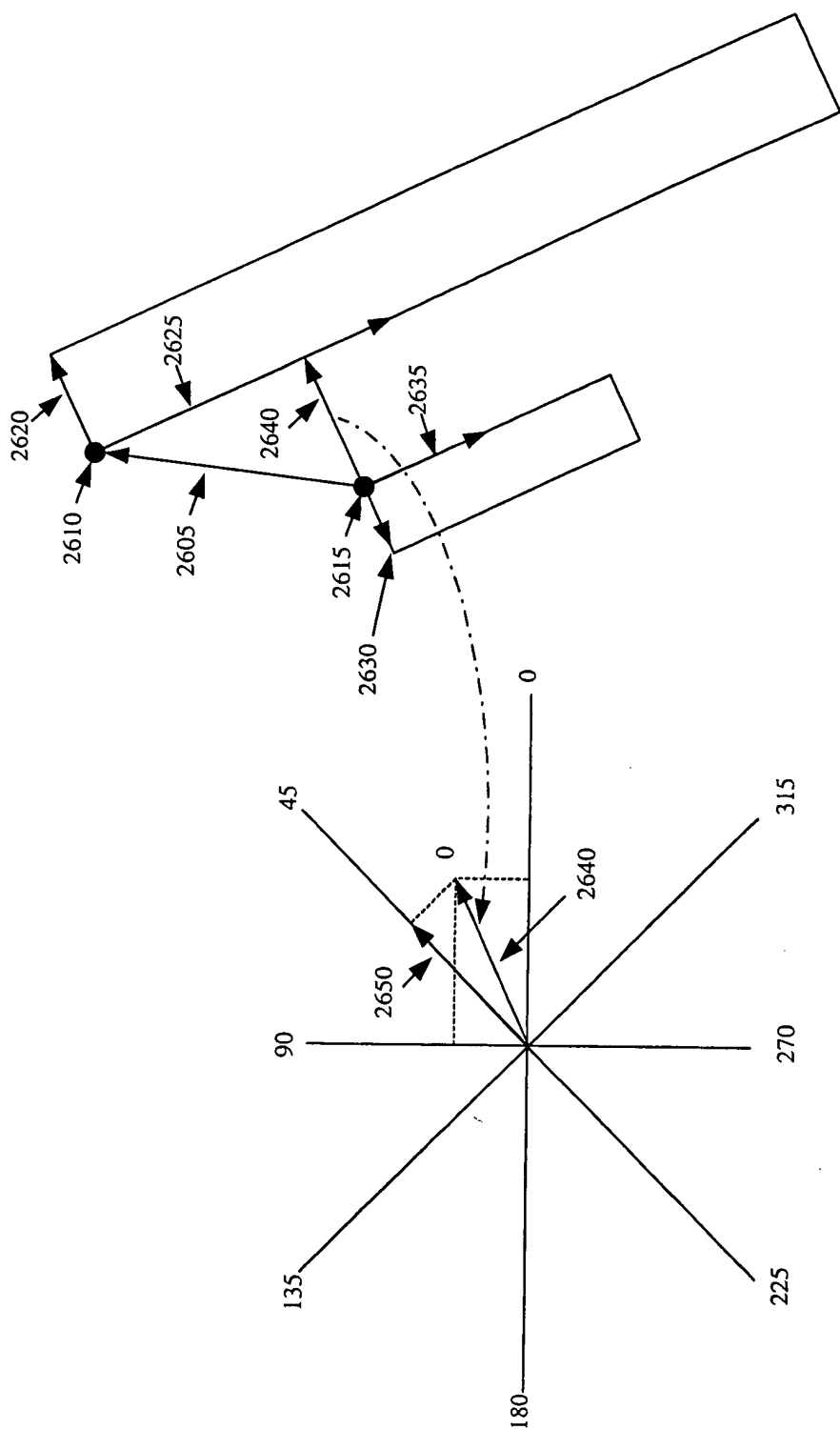
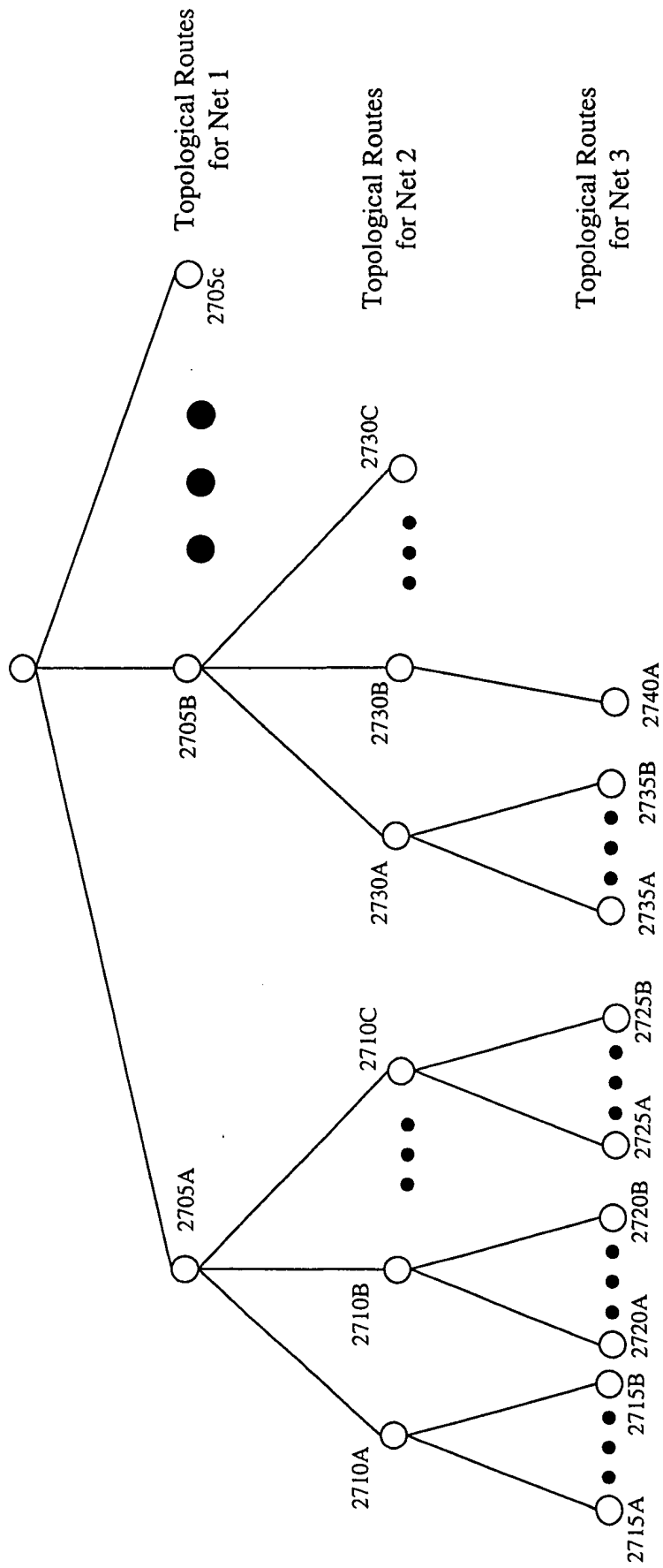
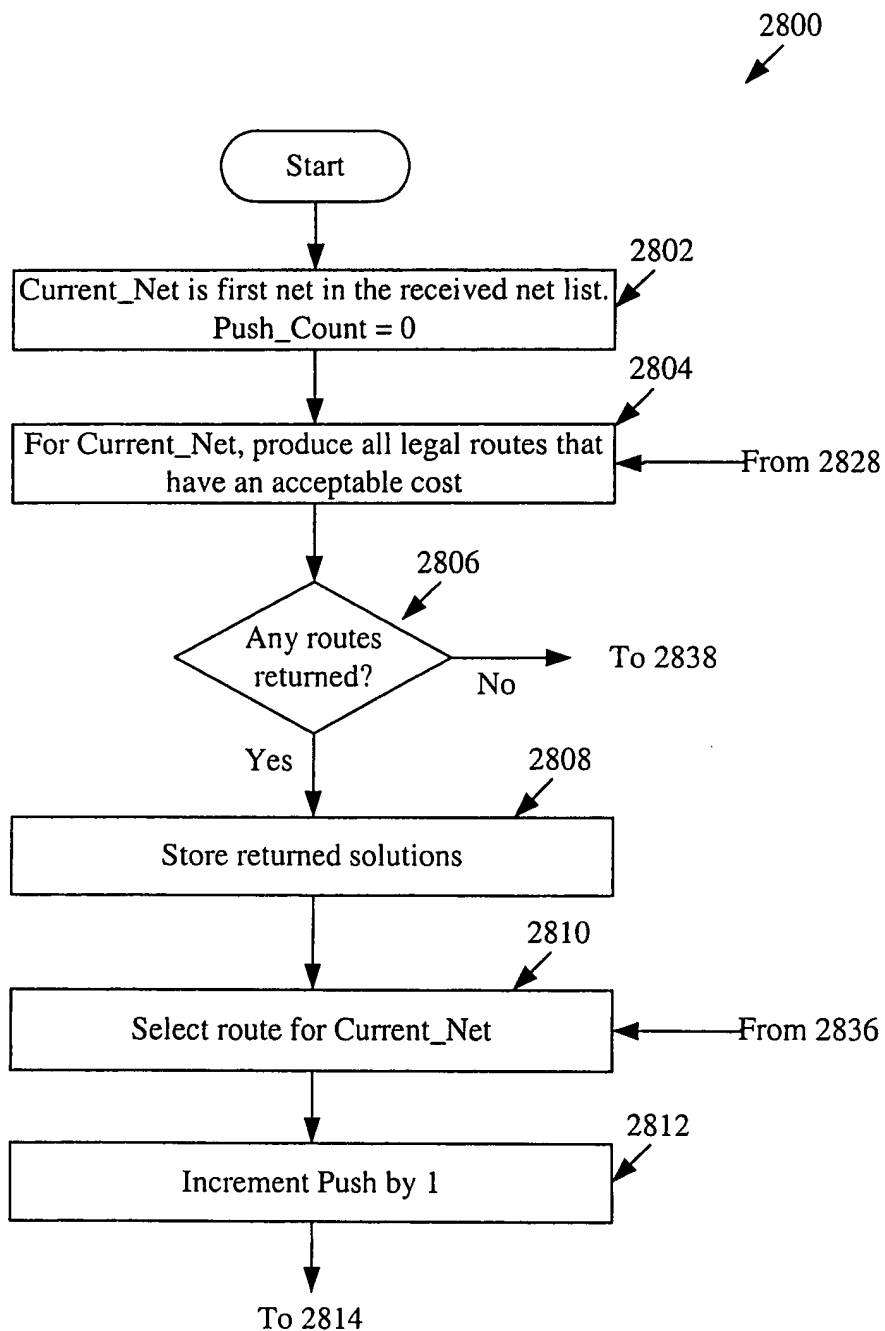


Figure 26

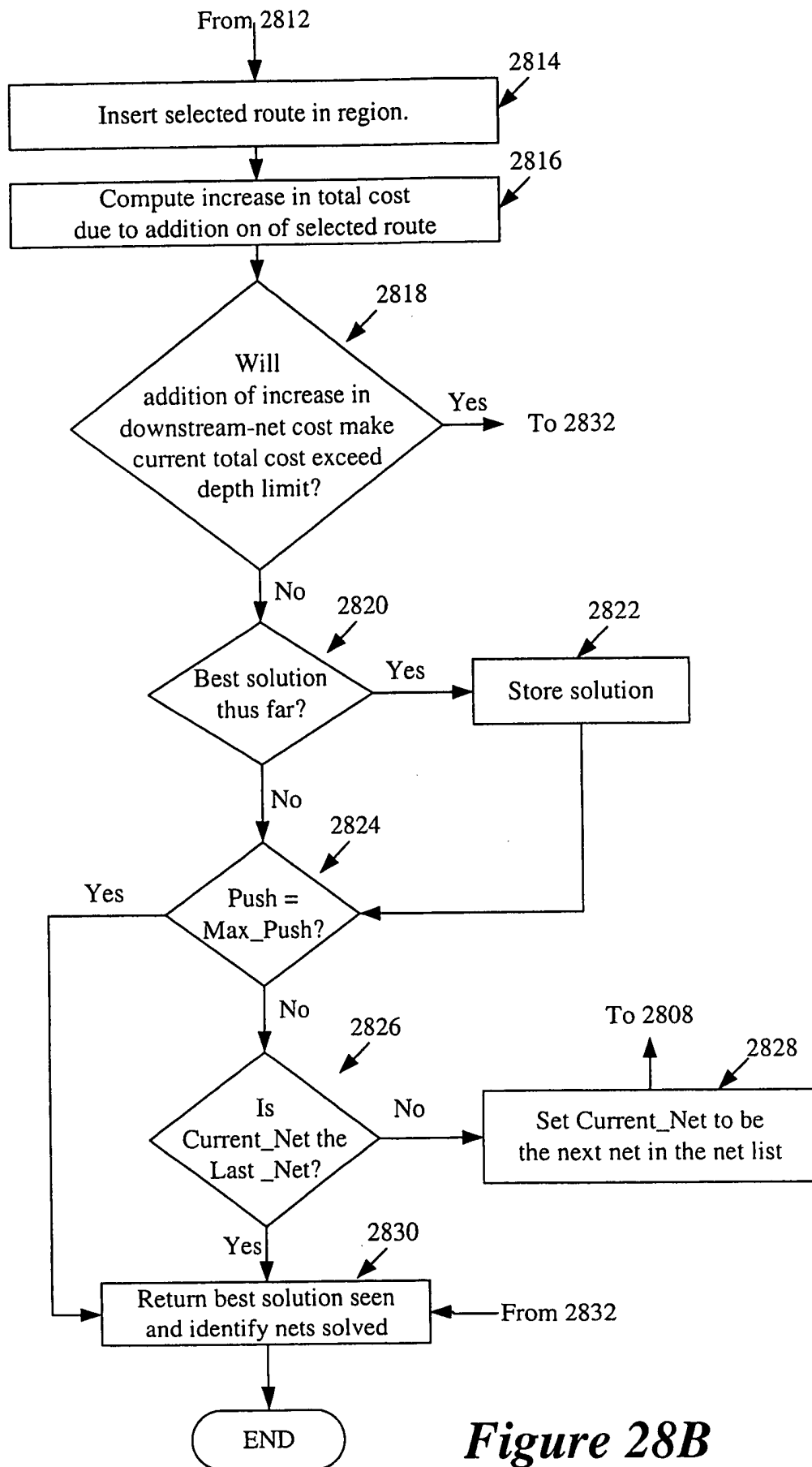


*Figure 27*

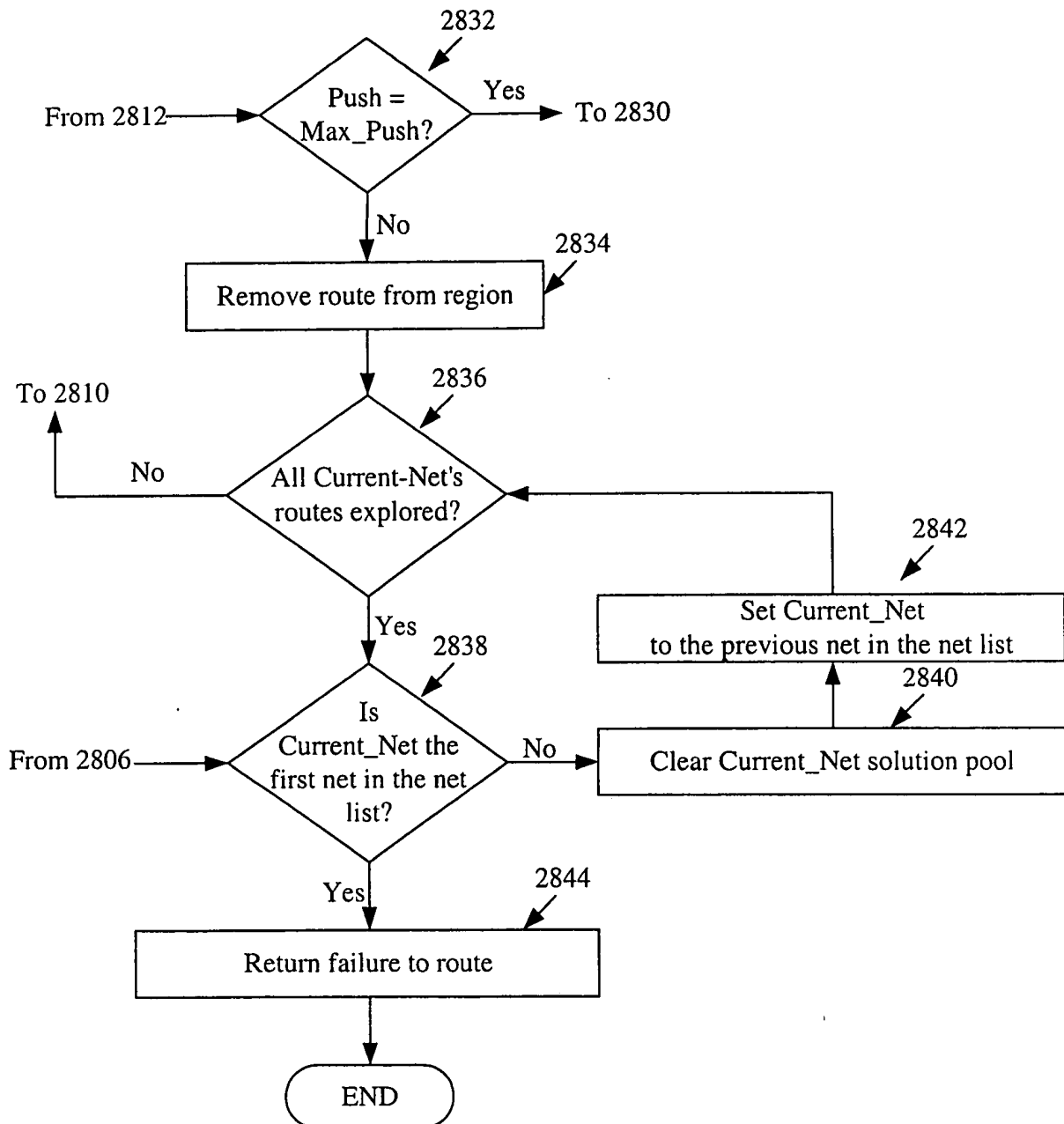


**Figure 28A**

**Figure 28:**  $\frac{\text{Figure 28A}}{\frac{\text{Figure 28B}}{\text{Figure 28C}}}$

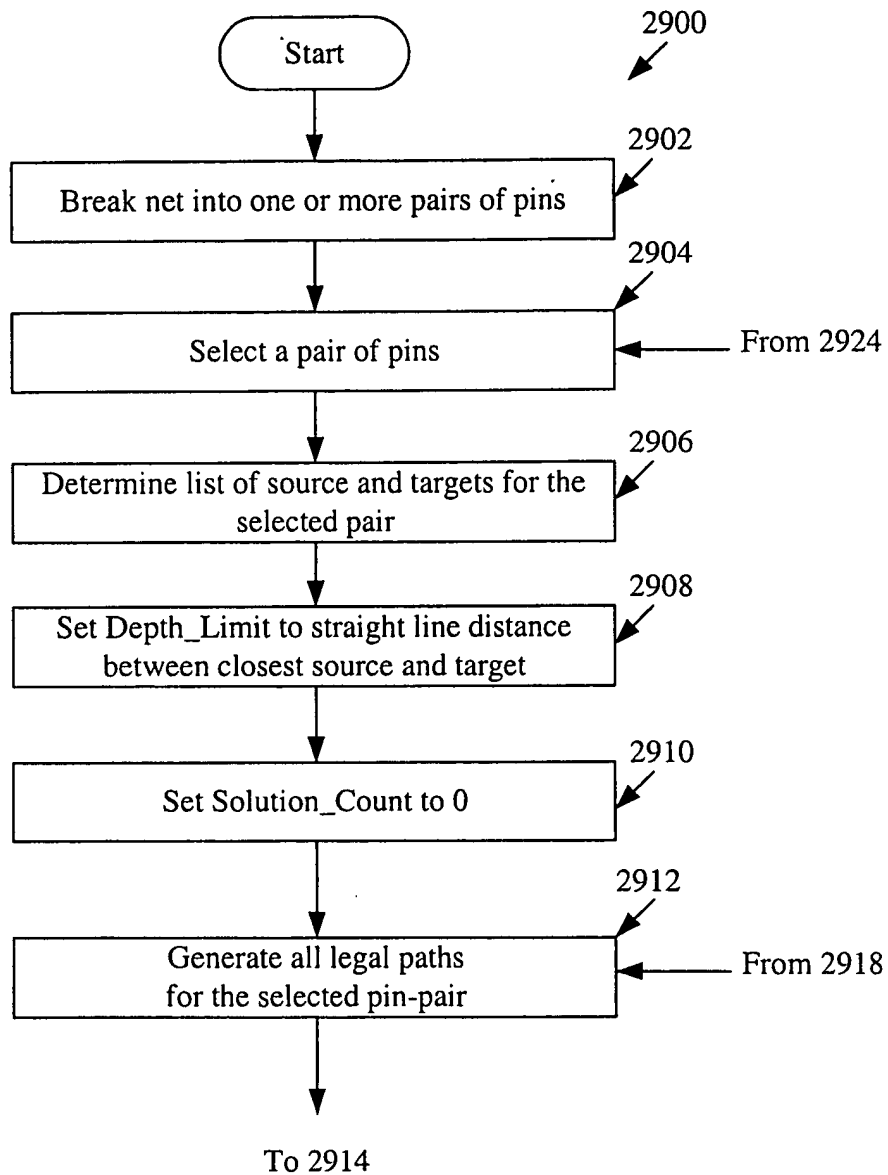


**Figure 28B**



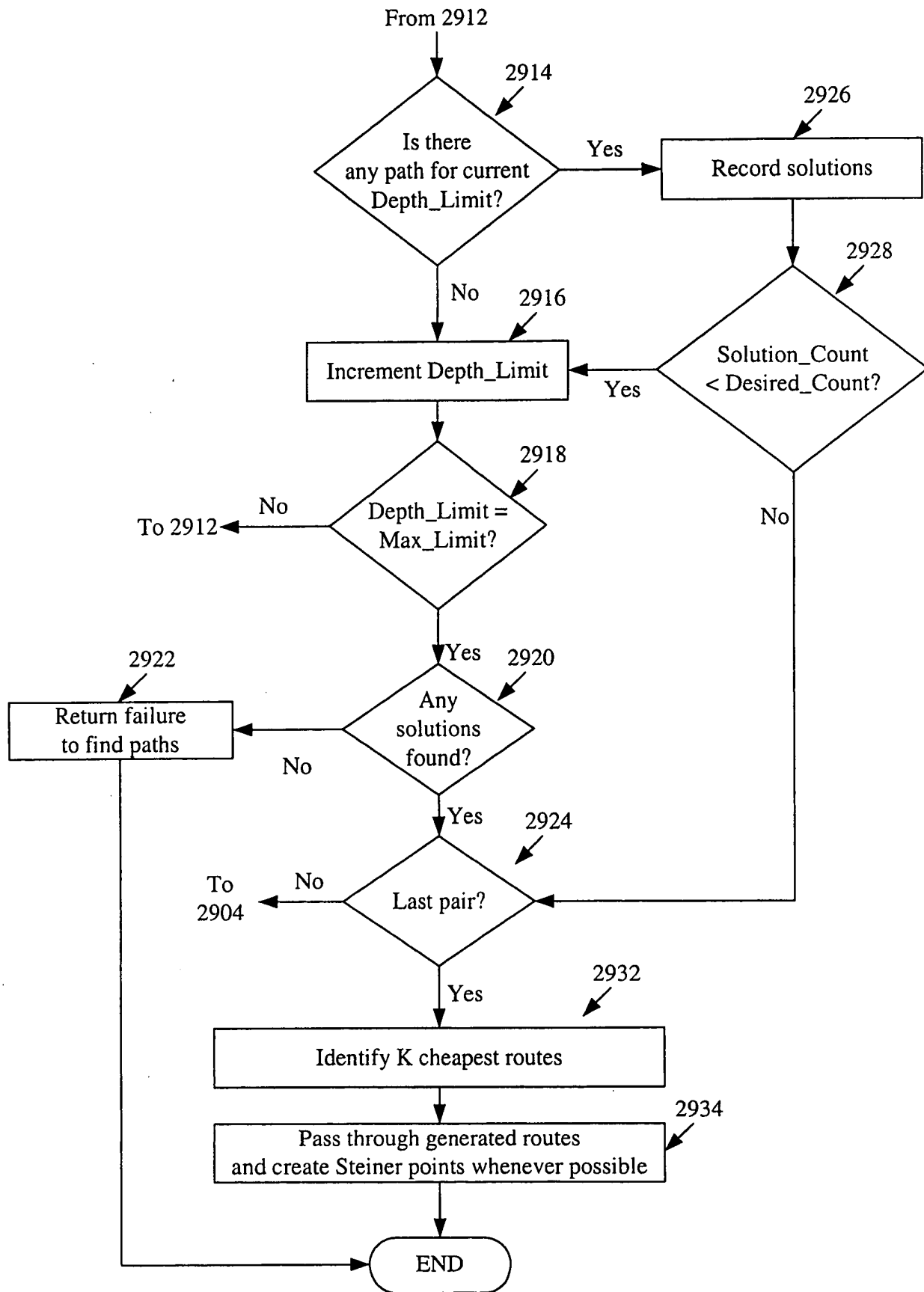
**Figure 28C**





**Figure 29A**

**Figure 29:**  $\frac{\text{Figure 29A}}{\text{Figure 29B}}$



**Figure 29B**

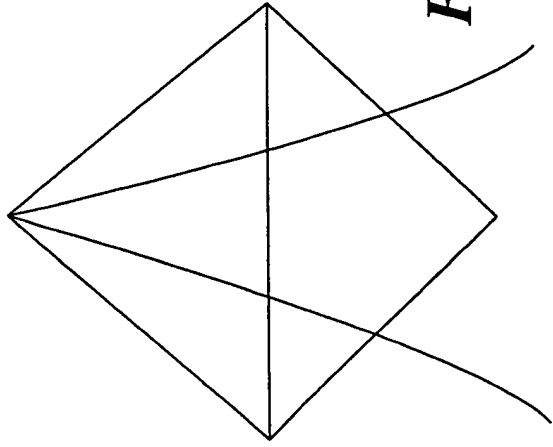


Figure 30A

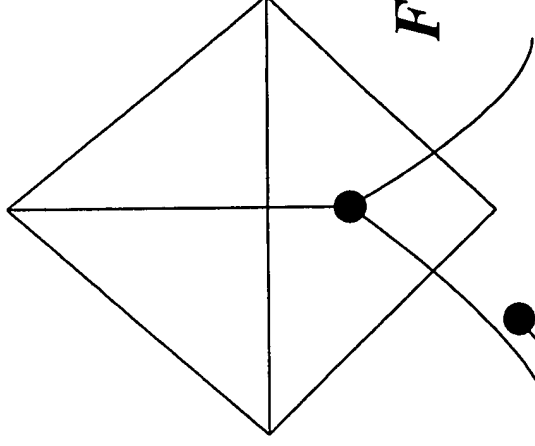


Figure 30B

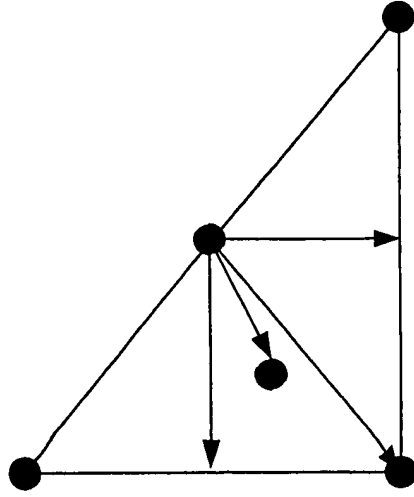


Figure 32

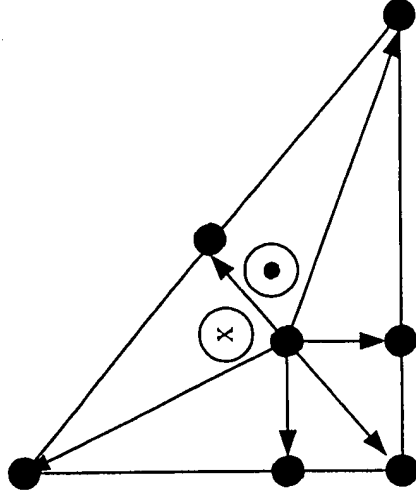


Figure 34

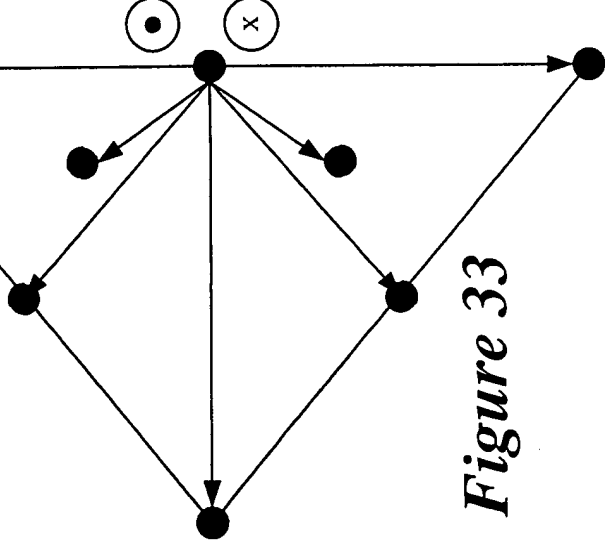
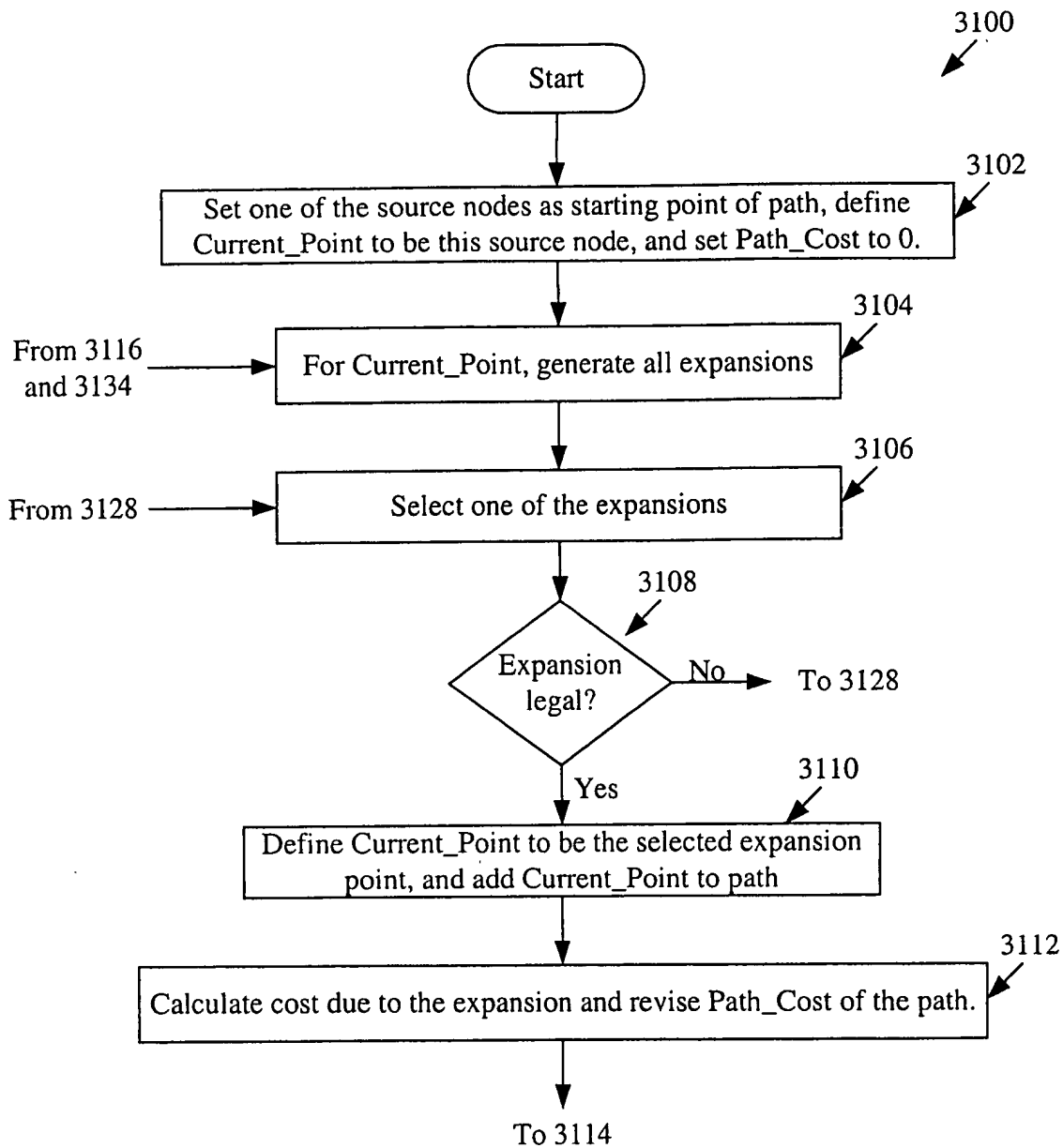
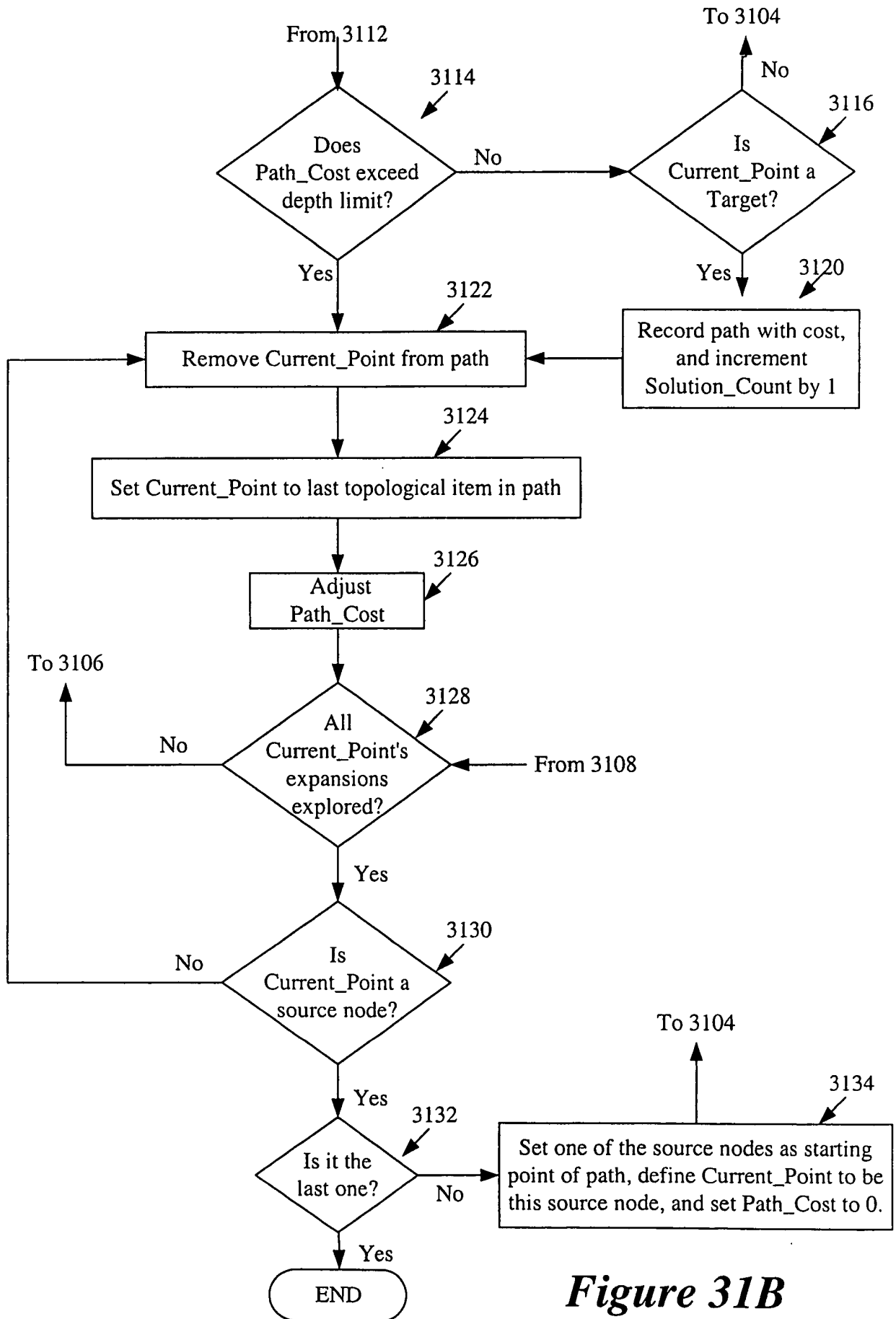


Figure 33



**Figure 31A**

**Figure 31:**  $\frac{\text{Figure 31A}}{\text{Figure 31B}}$



**Figure 31B**

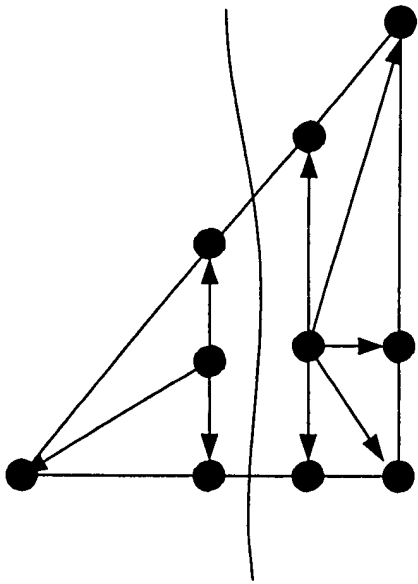


Figure 35

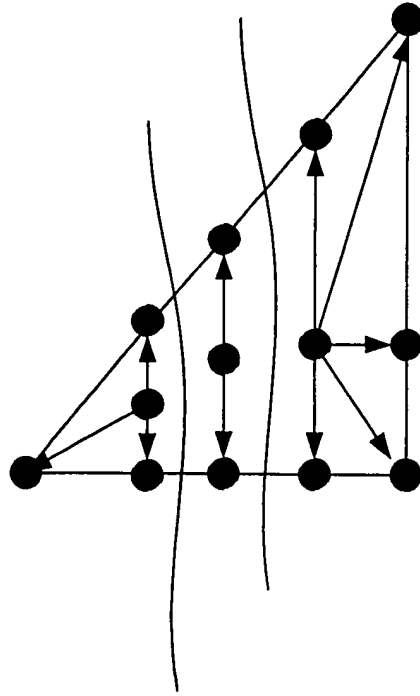


Figure 36

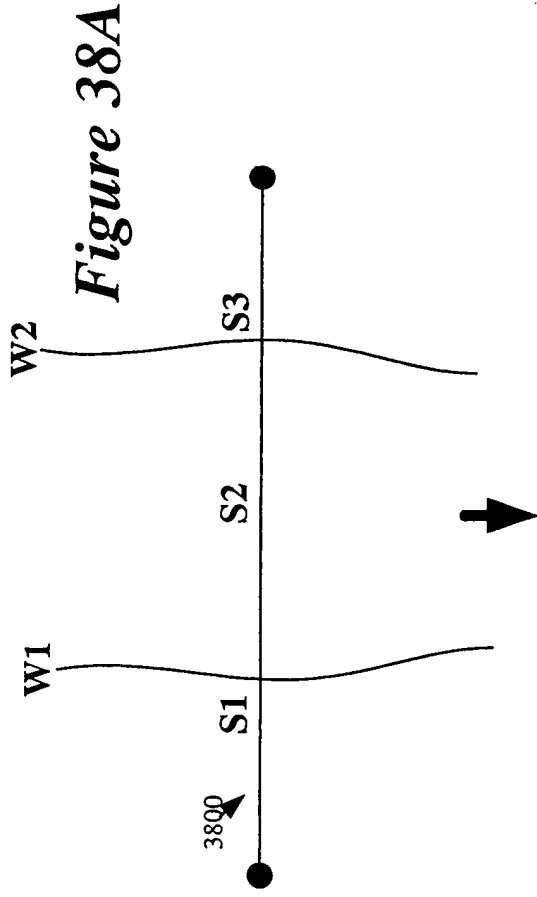


Figure 38A

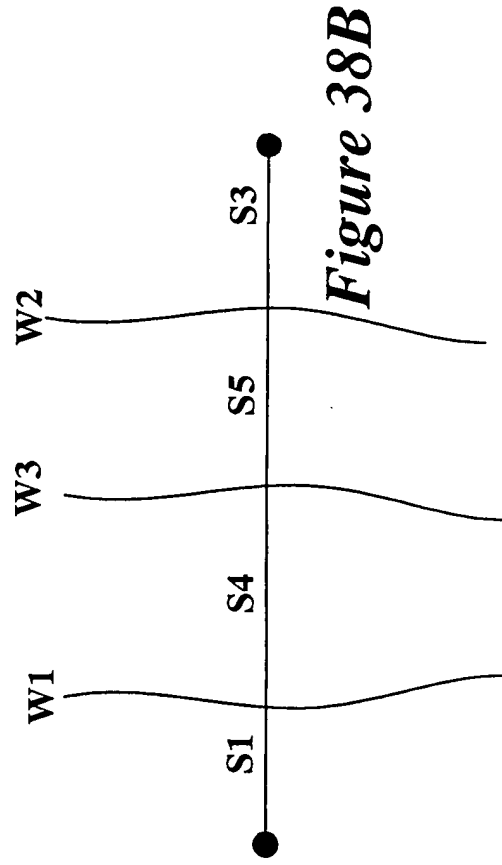
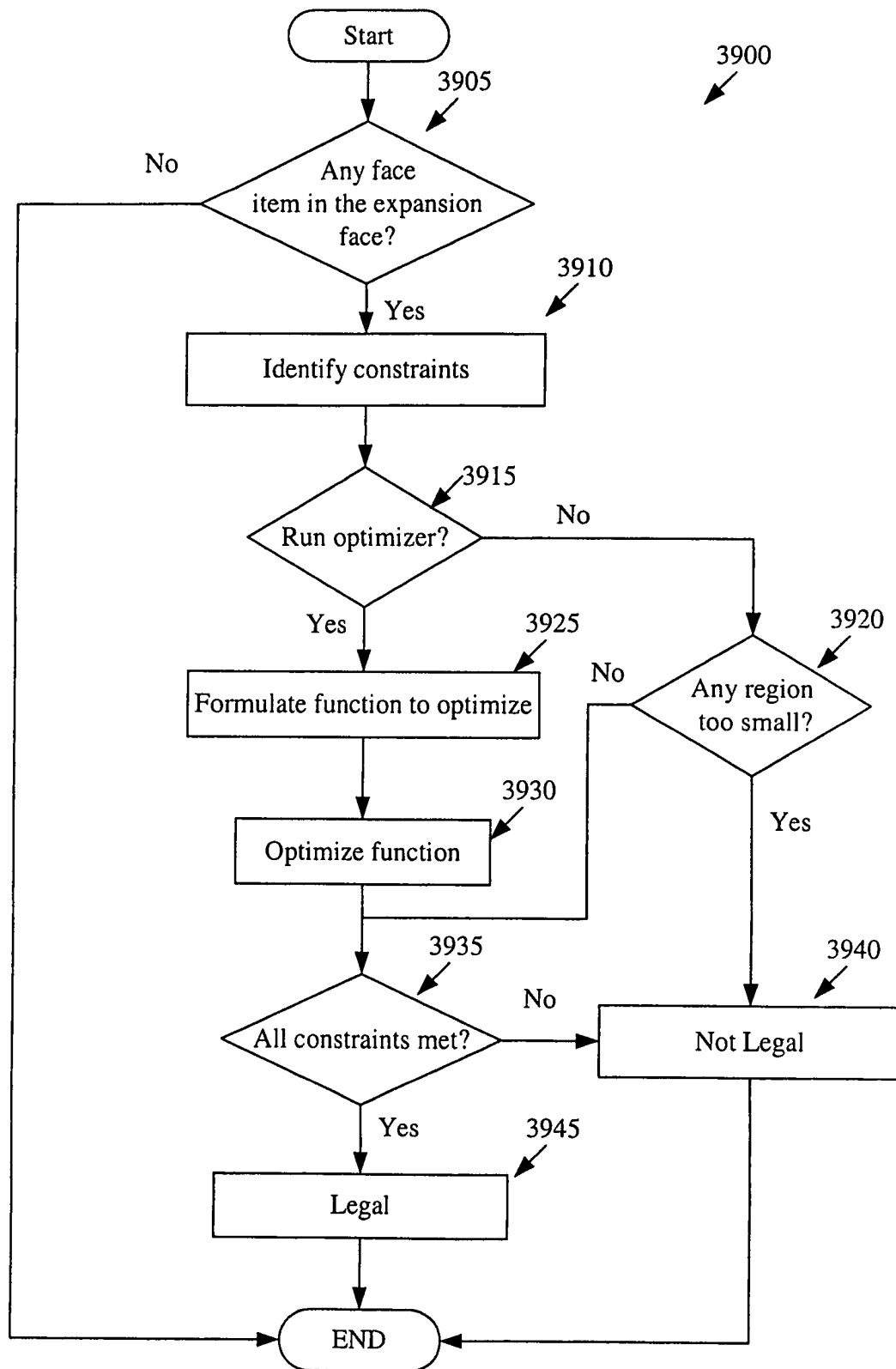


Figure 38B

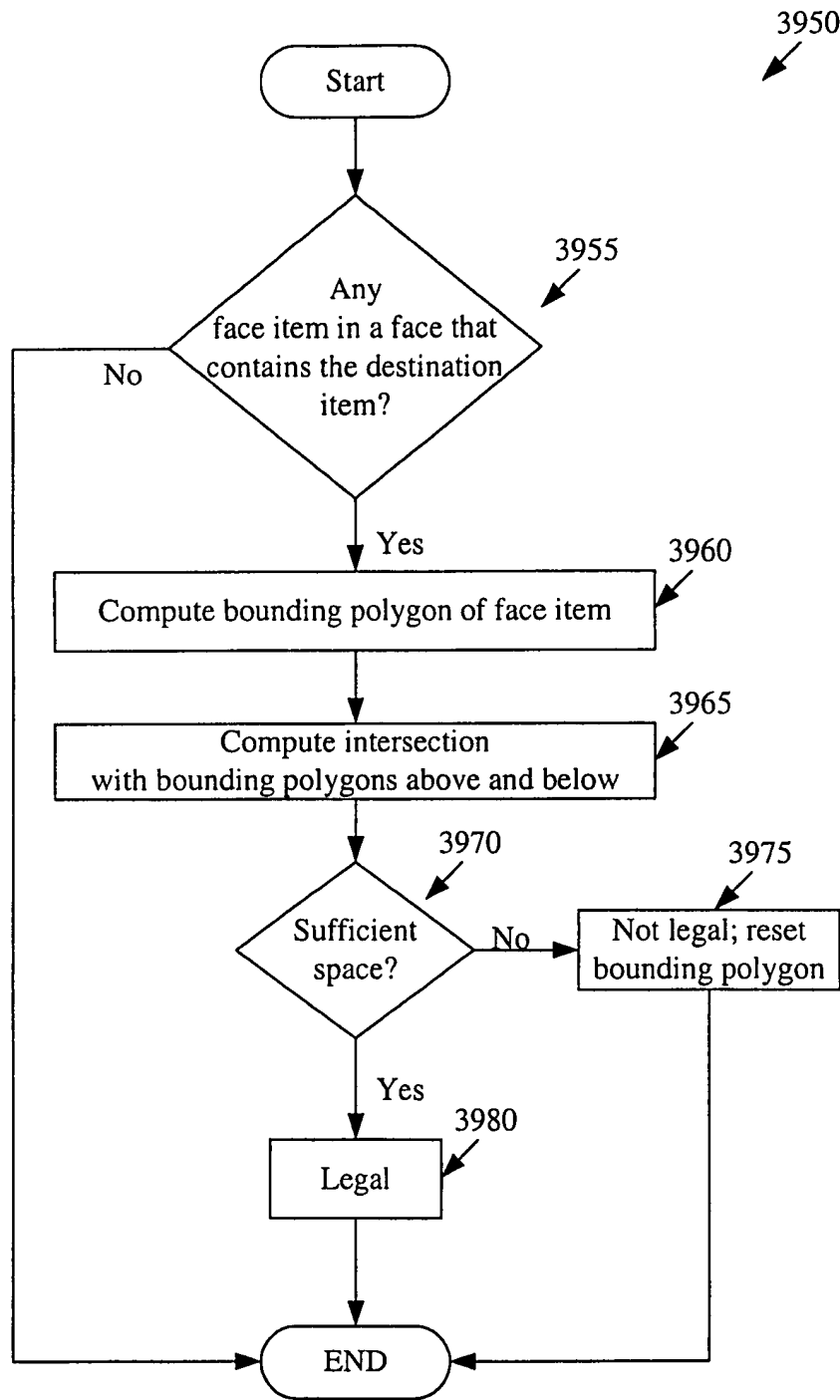
To:		Node	Face Item	Edge Item
From:	Node	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> <li>• Edge</li> <li>• Capacity</li> </ul>
Face Item	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> <li>• Edge</li> <li>• Capacity</li> </ul>
Edge Item	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> <li>• Edge</li> <li>• Capacity</li> </ul>

*Figure 37*

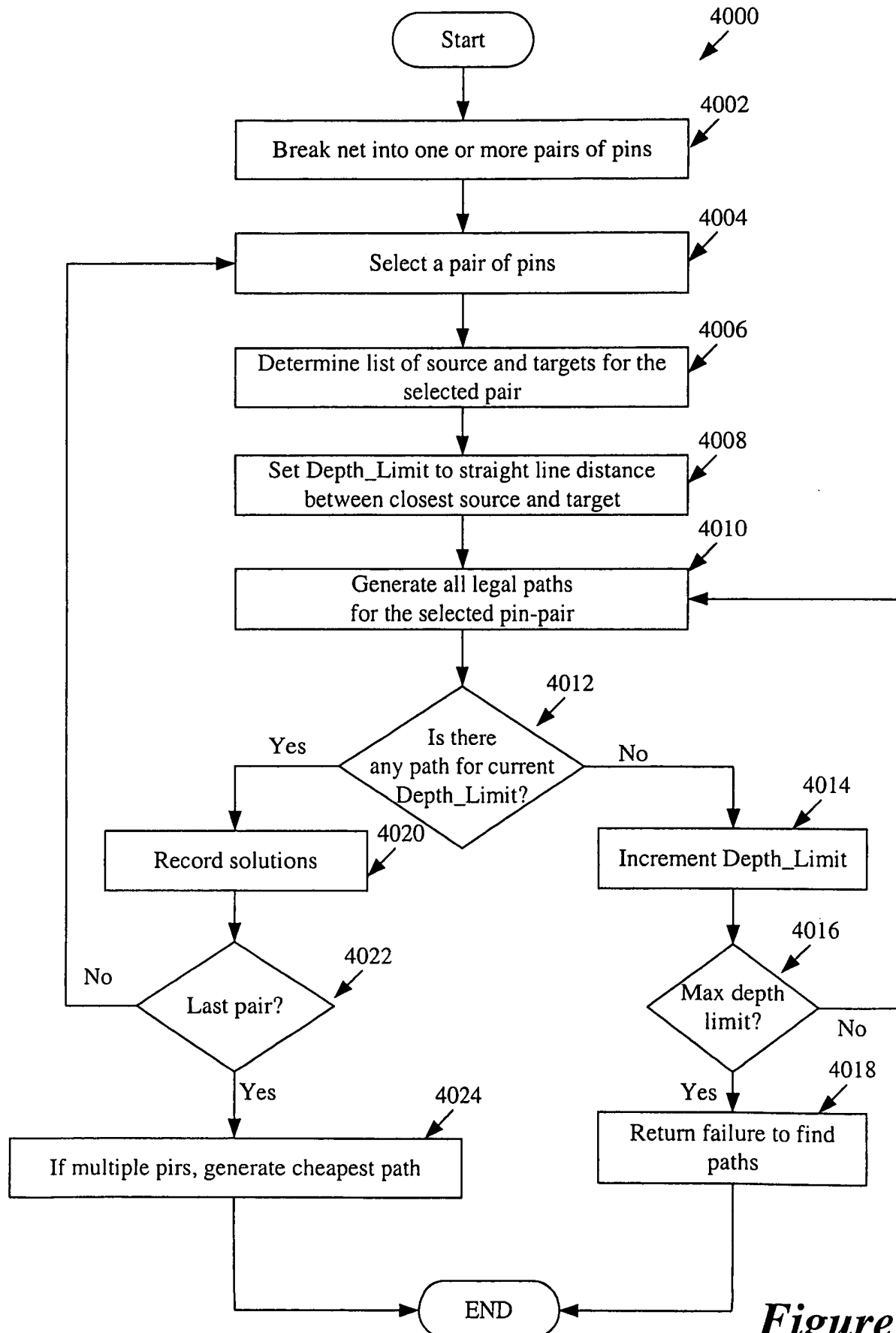


**Figure 39A**

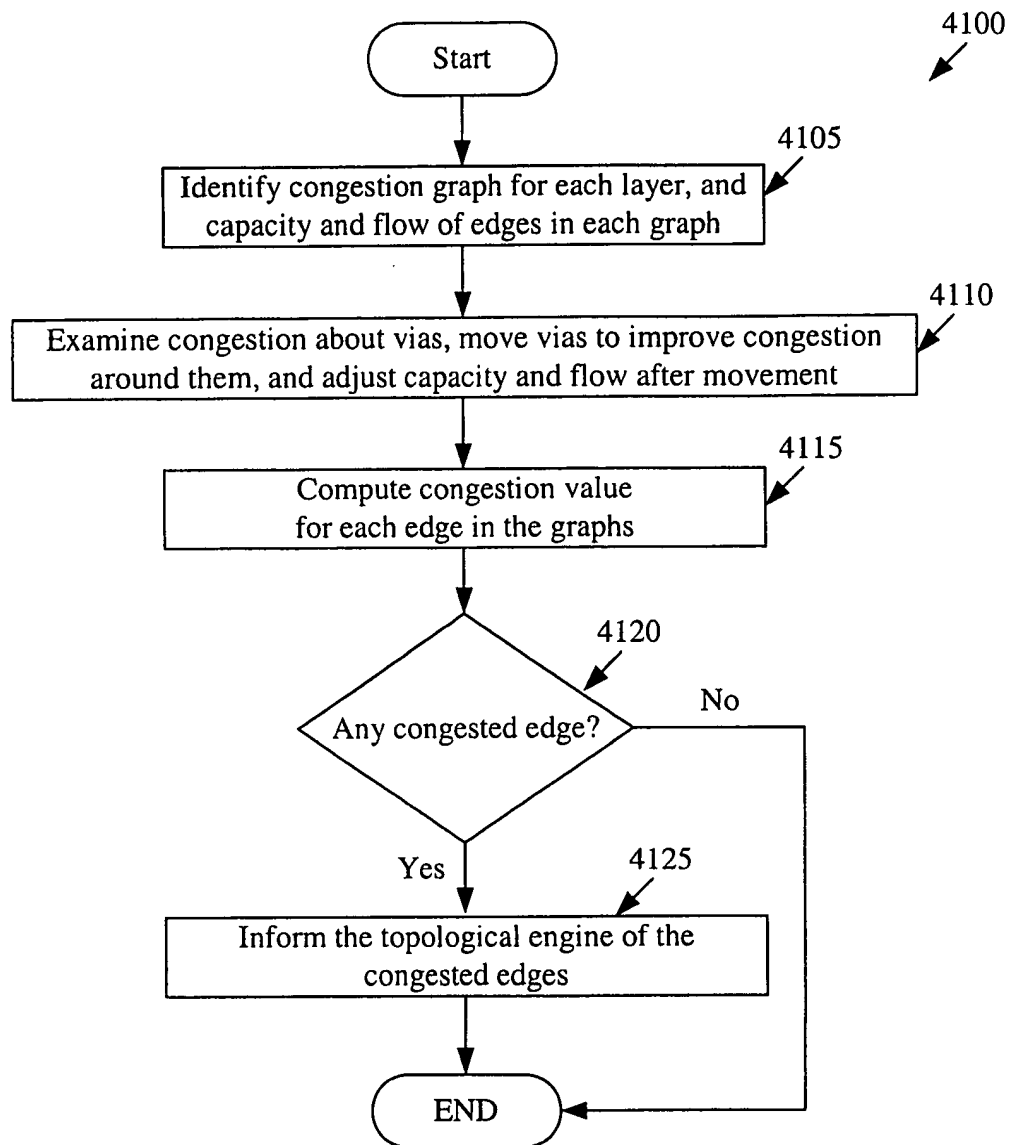




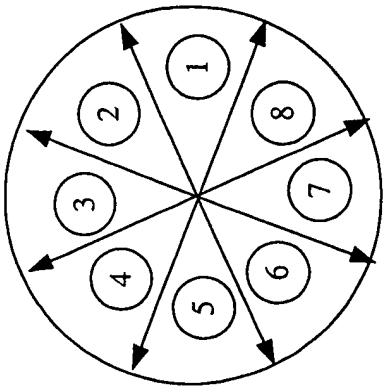
**Figure 39B**



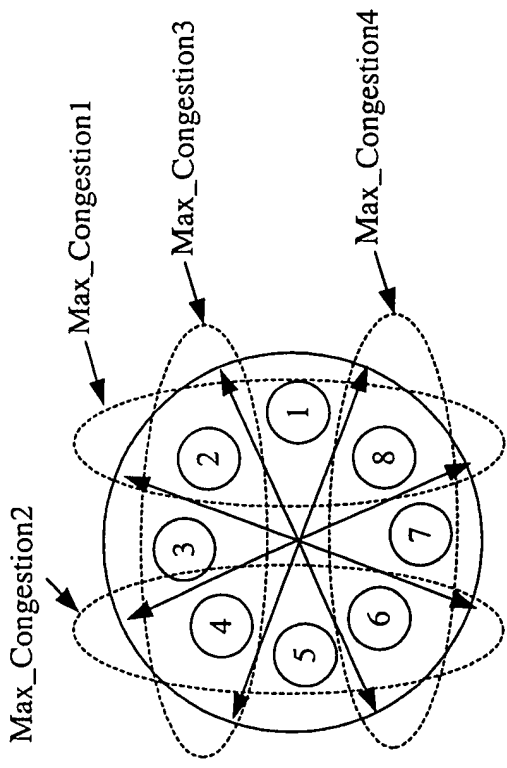
*Figure 40*



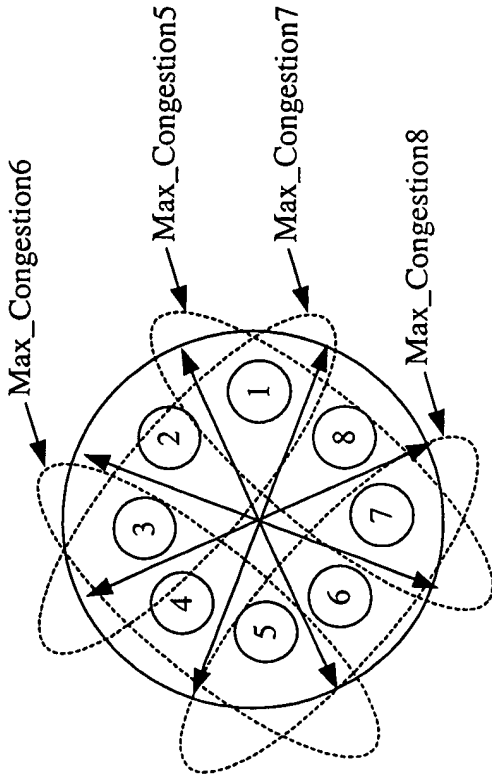
**Figure 41**



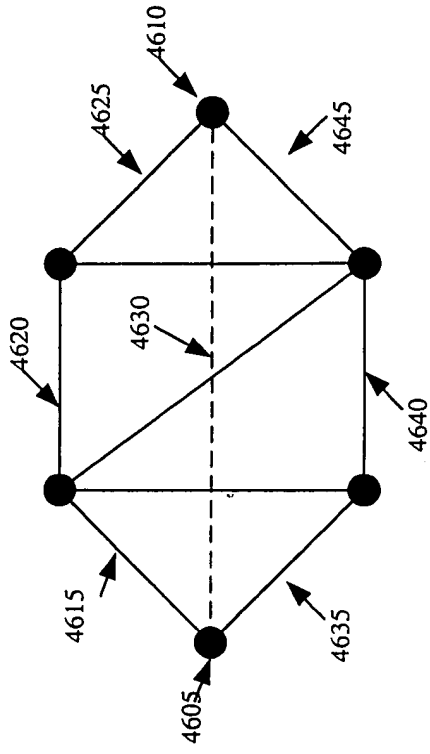
**Figure 42**



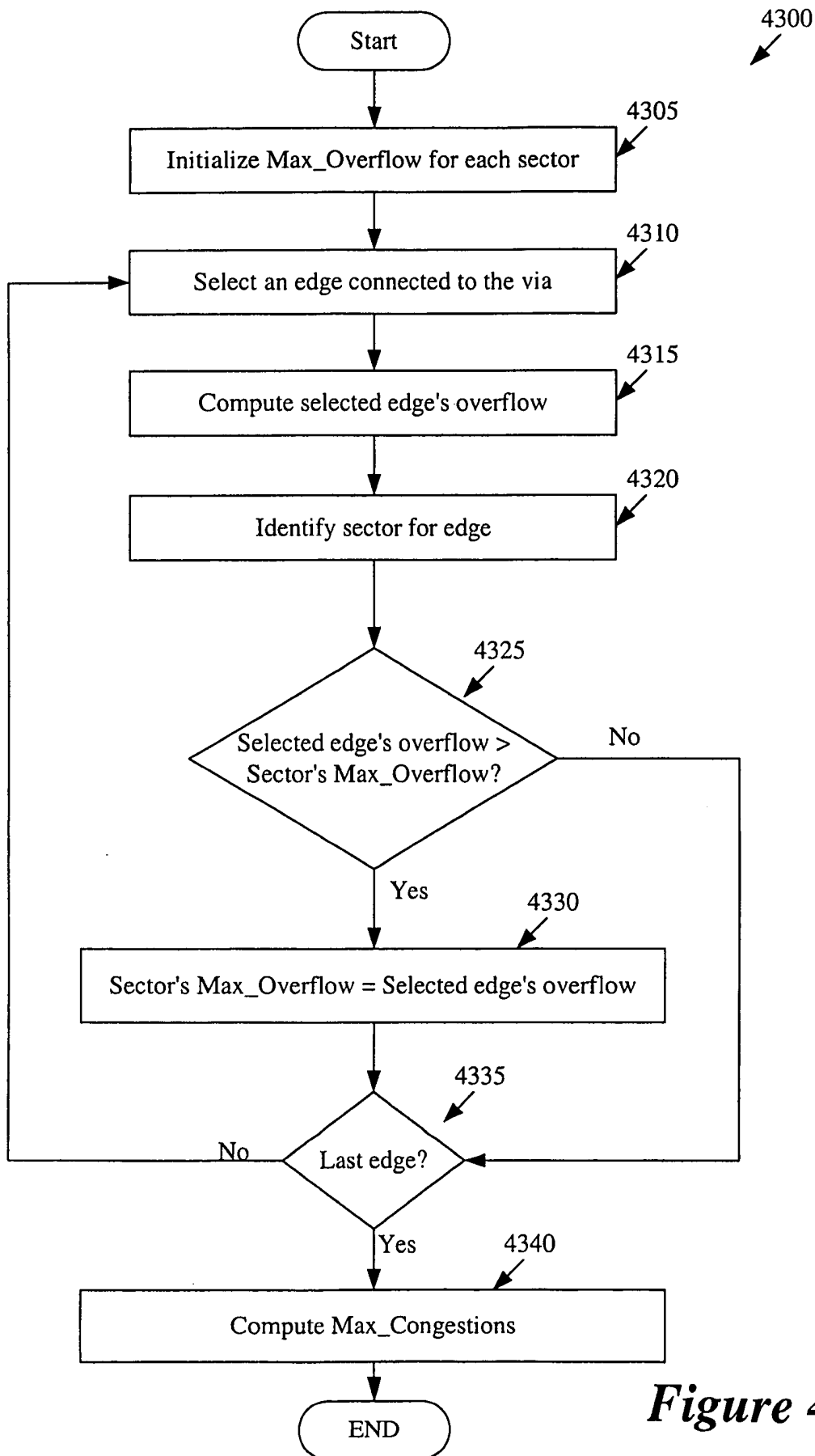
**Figure 44**



**Figure 45**



**Figure 46**



**Figure 43**

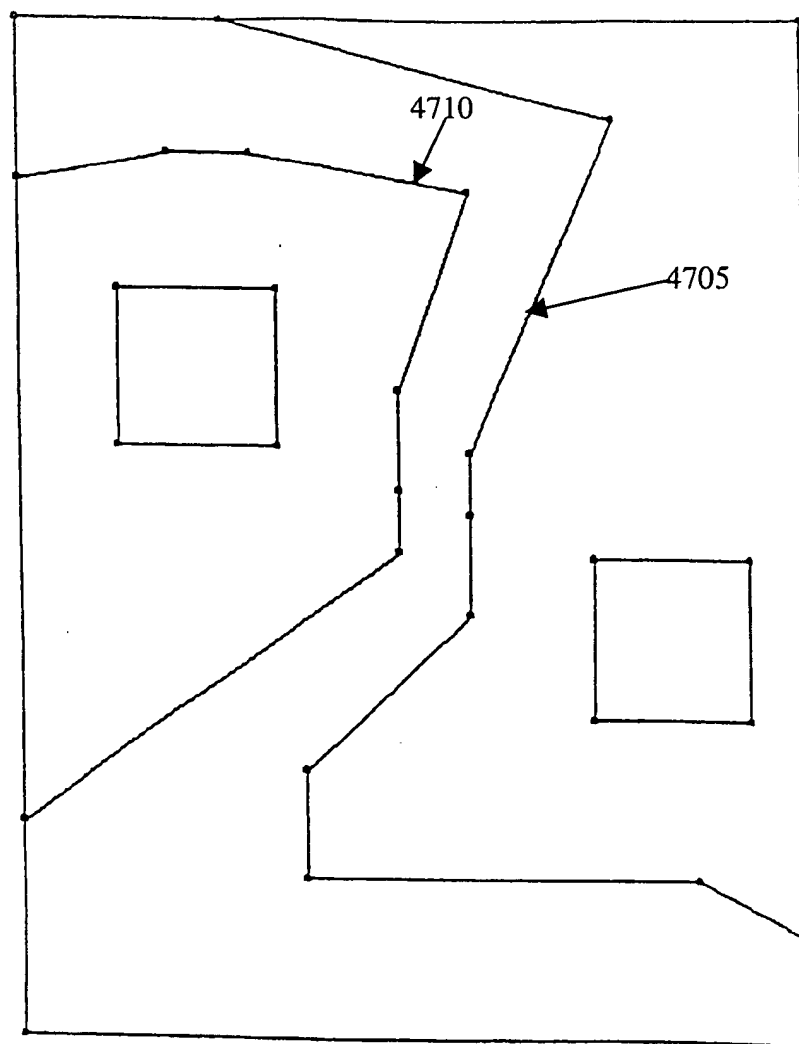


Figure 47

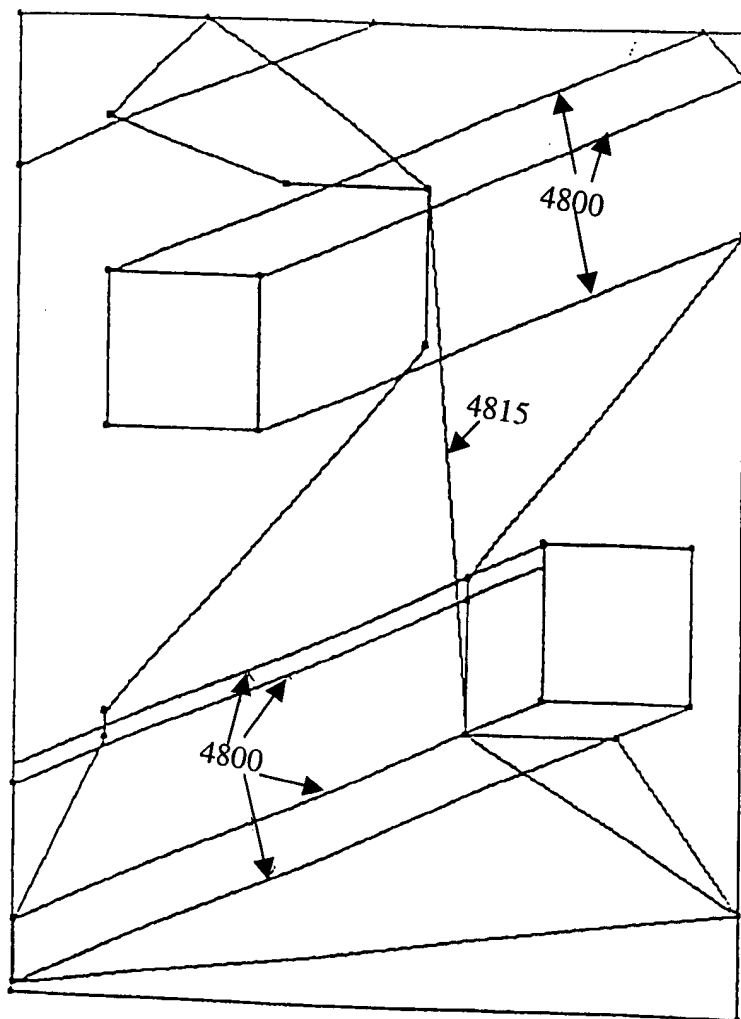


Figure 48A

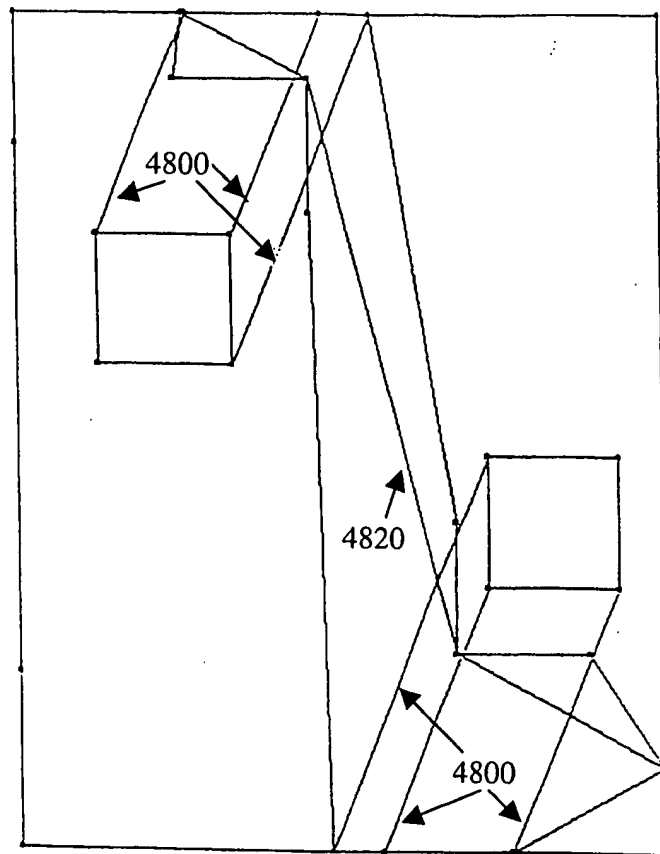


Figure 48B



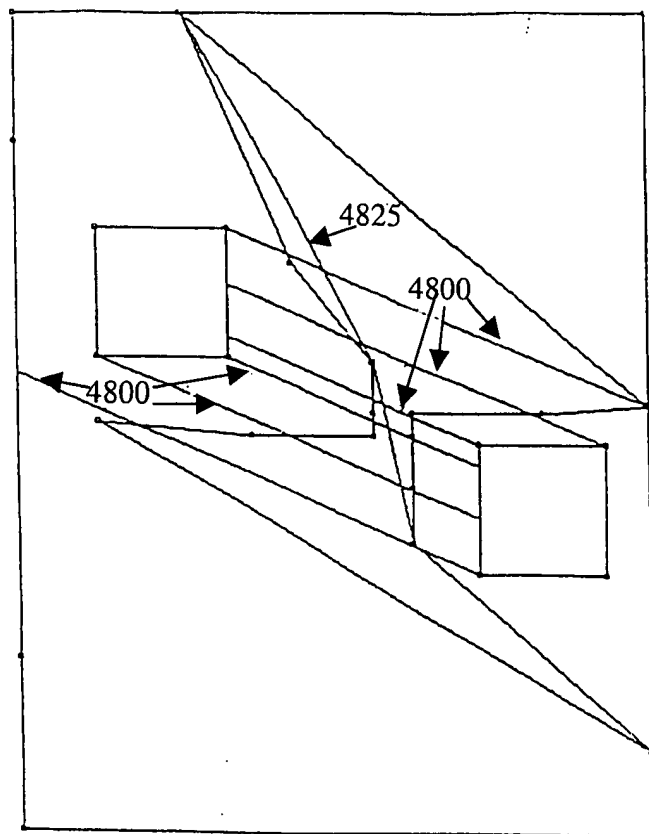


Figure 48C

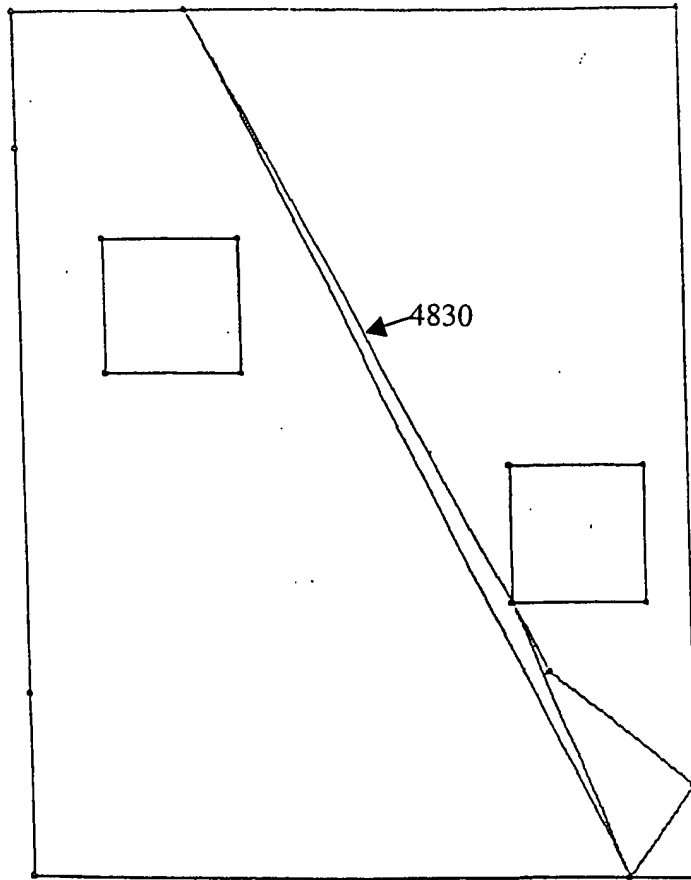
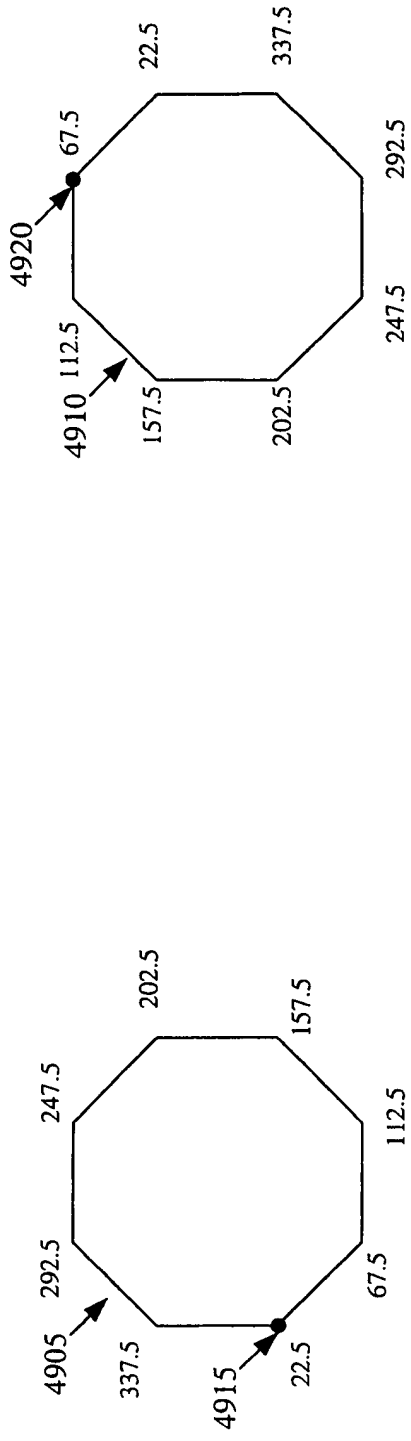
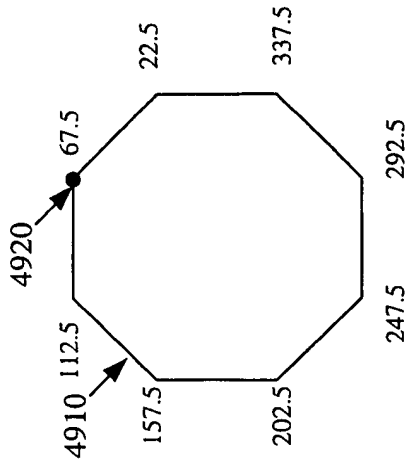


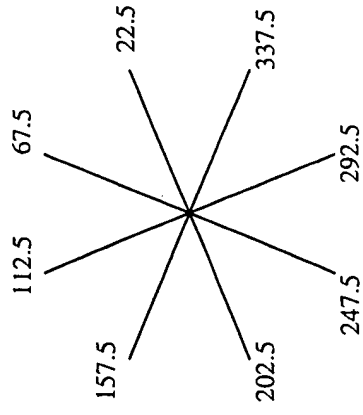
Figure 48D



**Figure 49A**



**Figure 49B**



**Figure 49C**

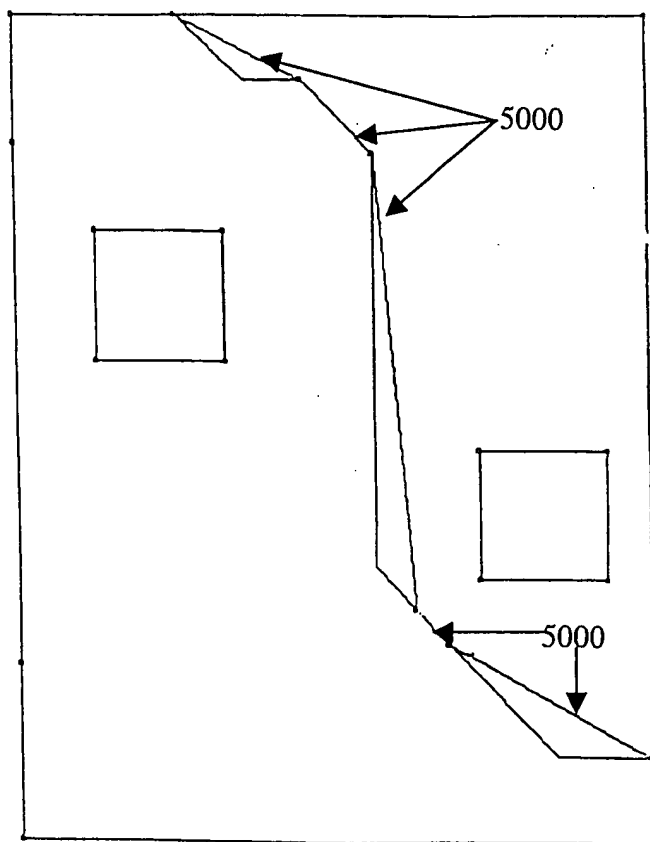
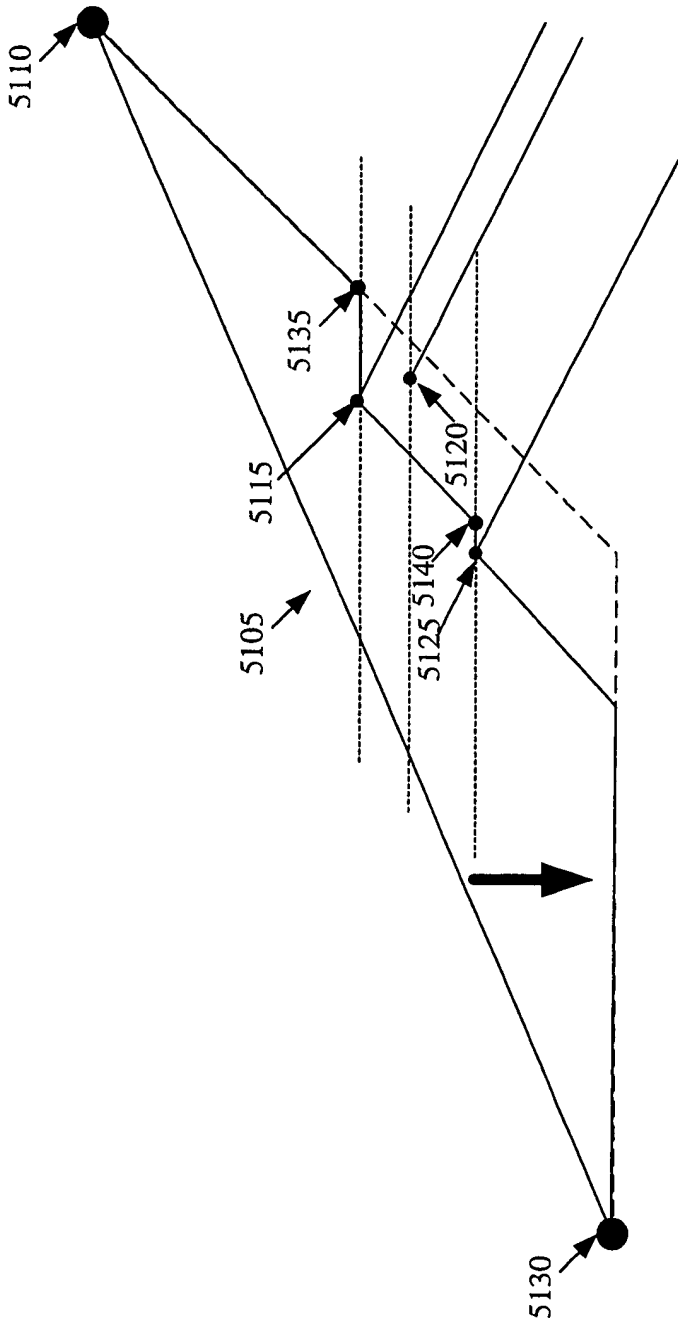


Figure 50



*Figure 51*

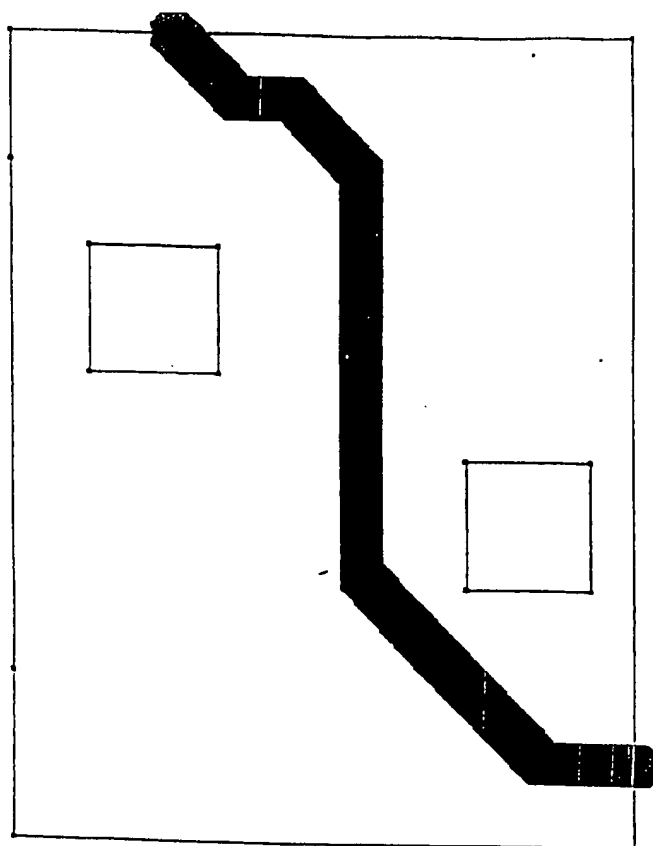
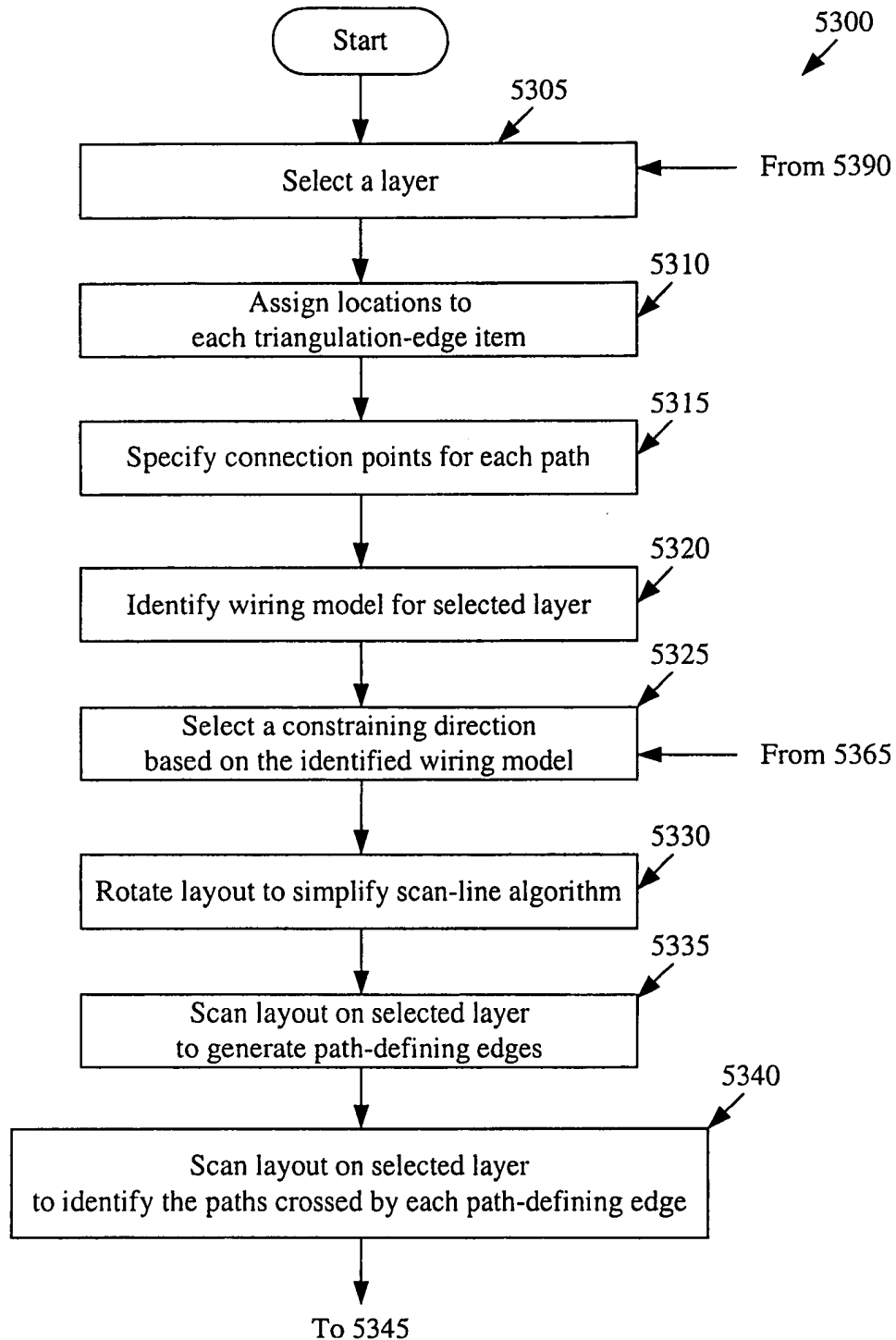
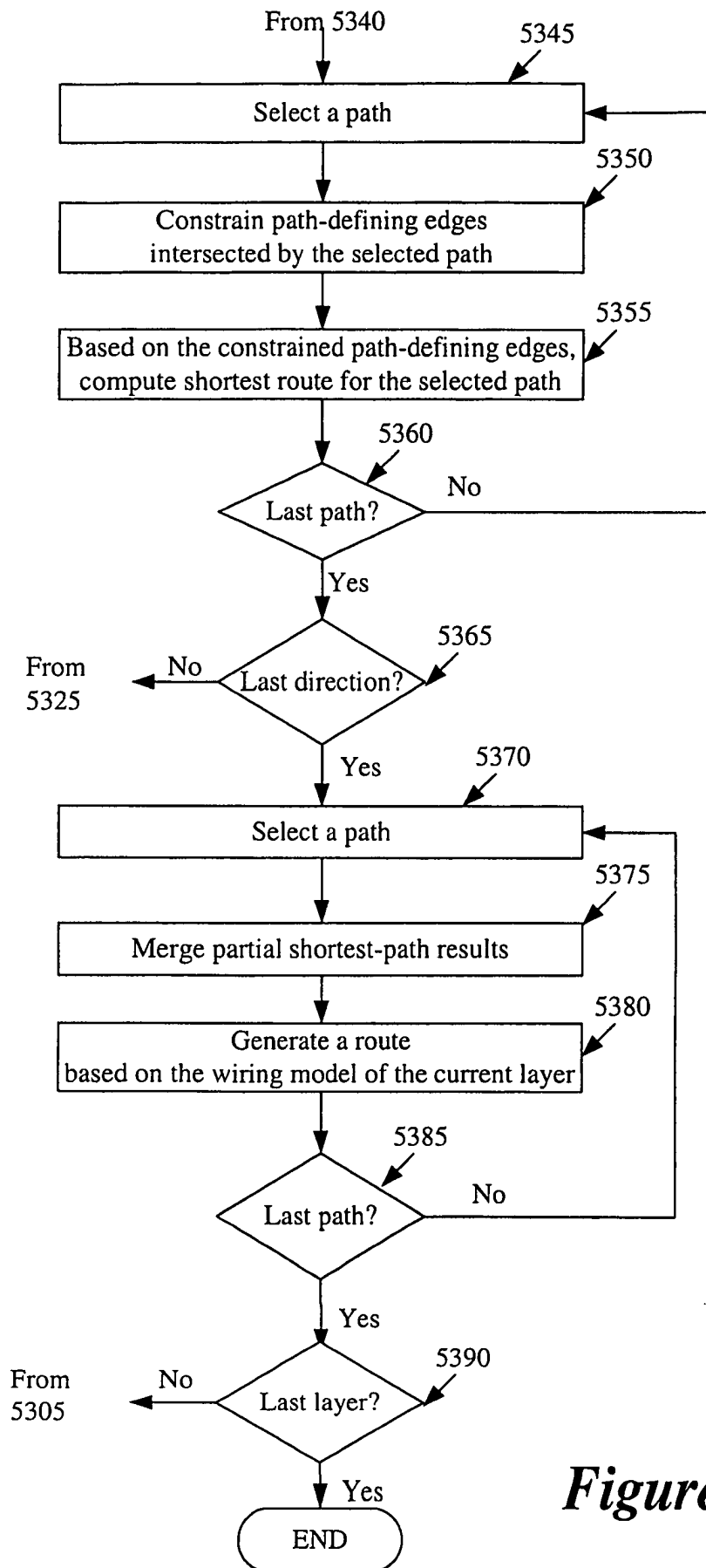


Figure 52



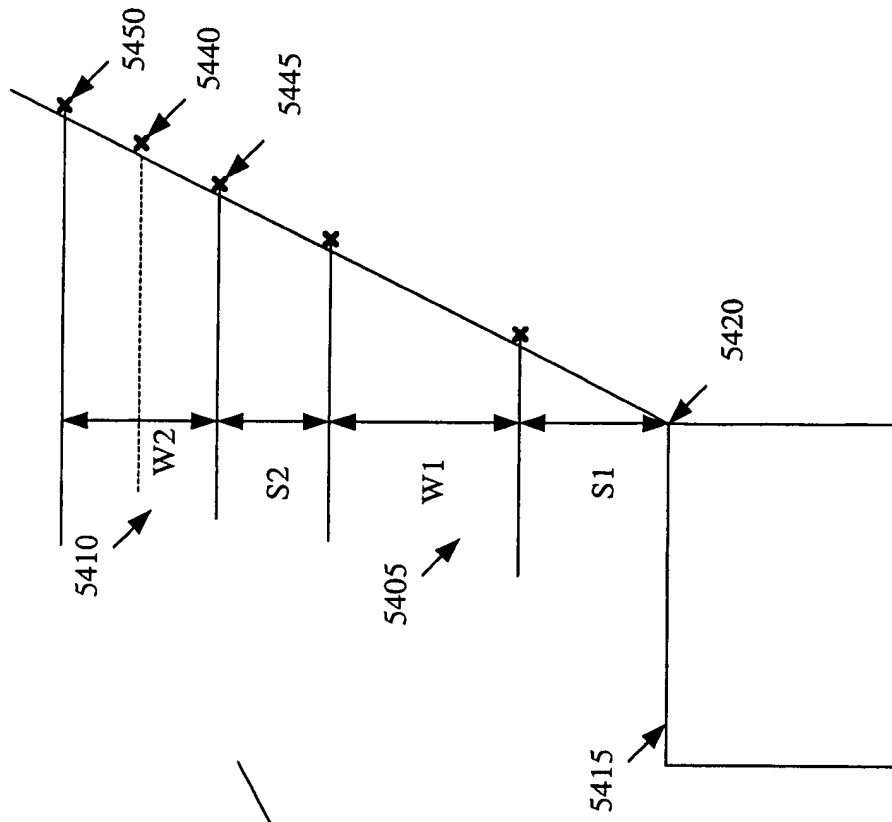
**Figure 53A**

**Figure 53:**  $\frac{\text{Figure 53A}}{\text{Figure 53B}}$

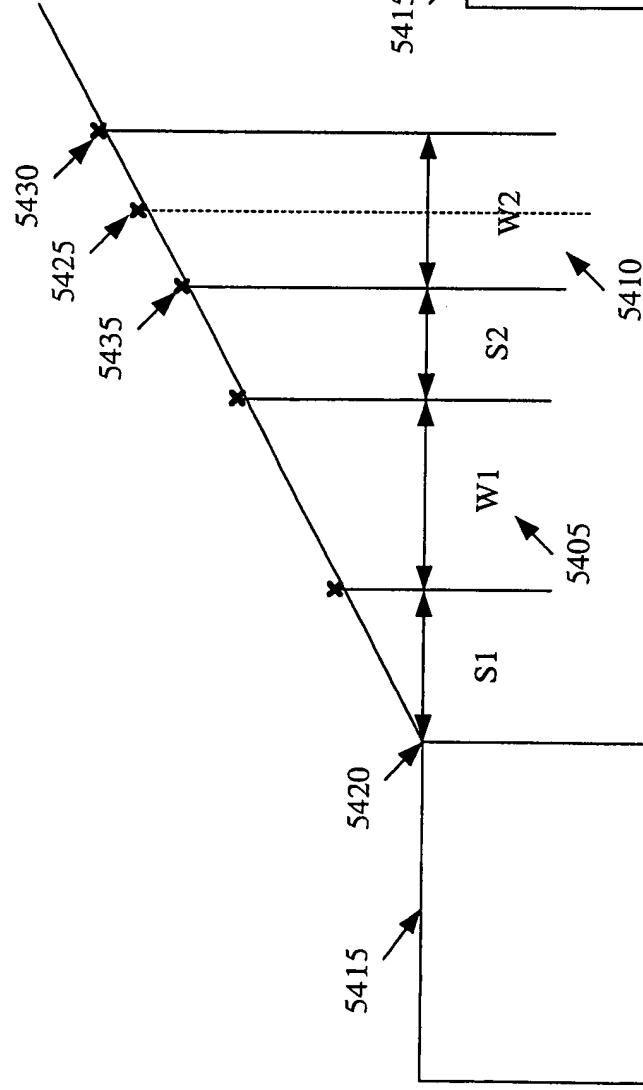


**Figure 53B**

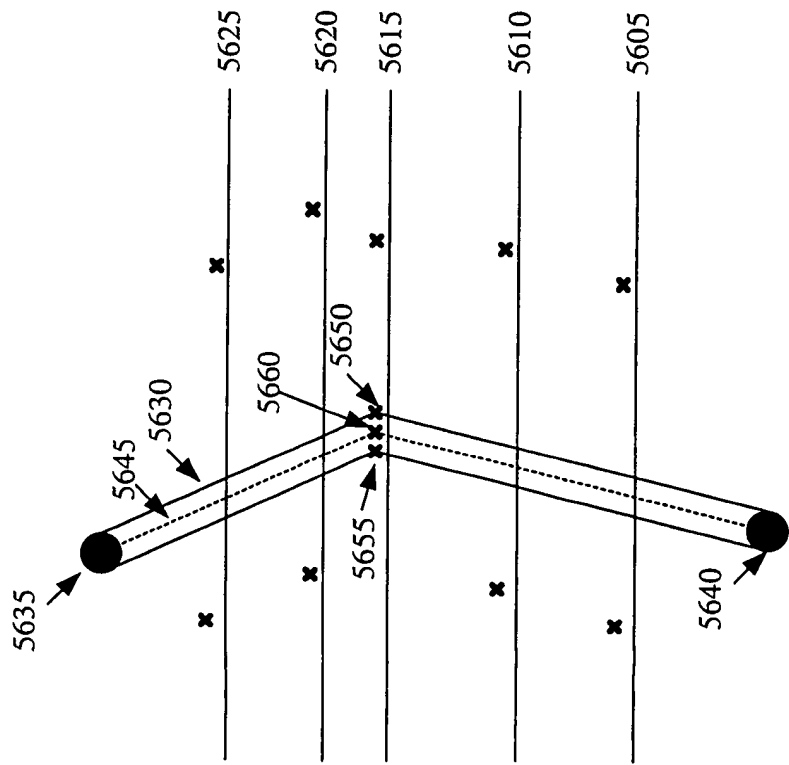




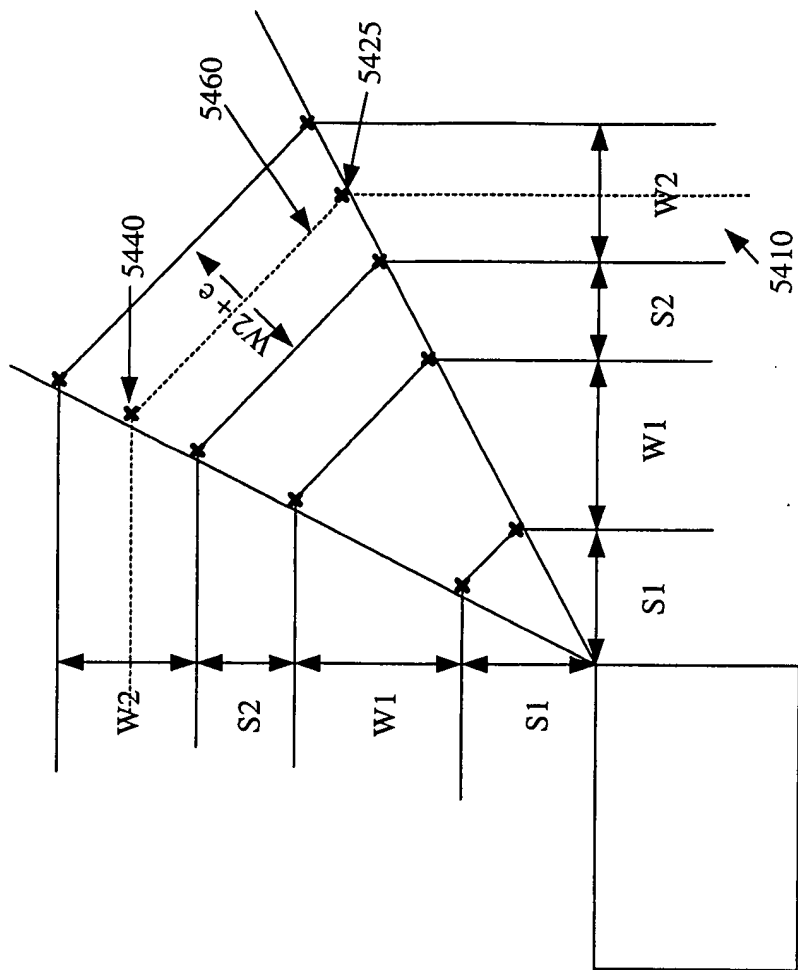
*Figure 55*



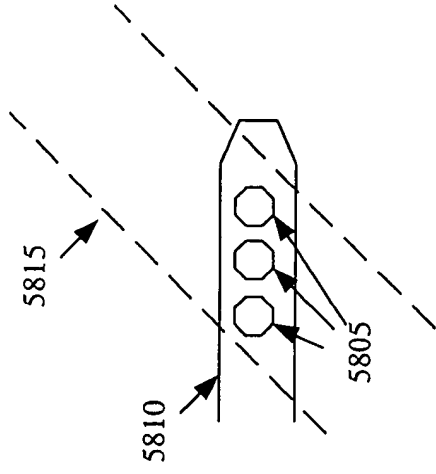
*Figure 54*



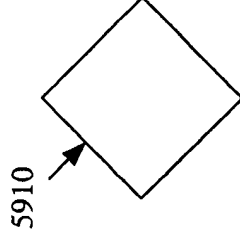
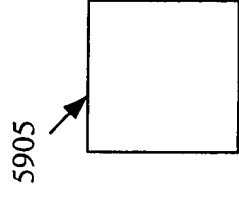
**Figure 56**



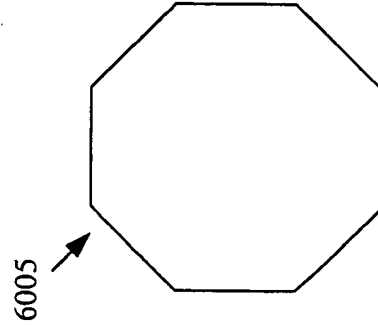
**Figure 57**



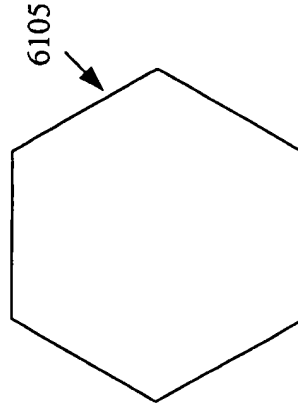
**Figure 58**



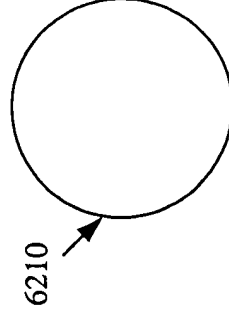
**Figure 59**



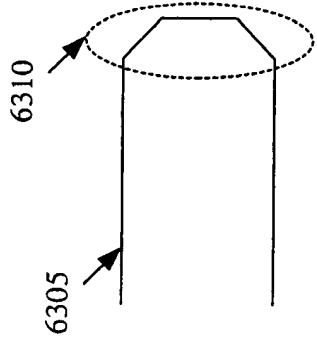
**Figure 60**



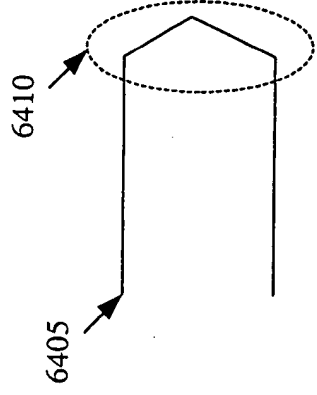
**Figure 61**



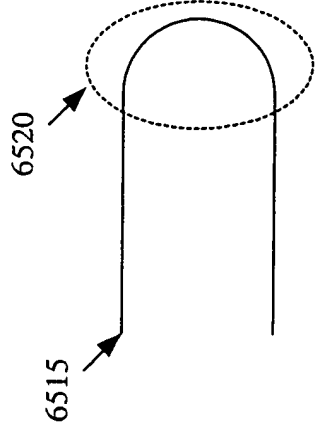
**Figure 62**



**Figure 63**

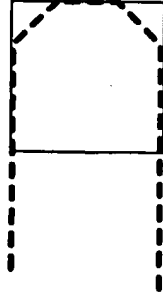


**Figure 64**

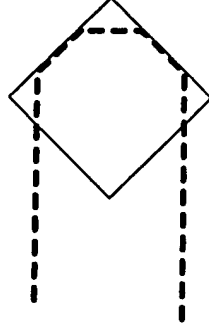


**Figure 65**

(1)



(2)

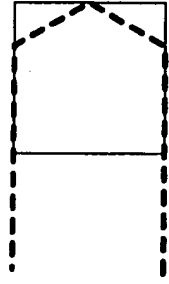


(3)



**Figure 66**

(1)



(2)

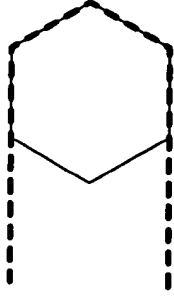


Figure 67

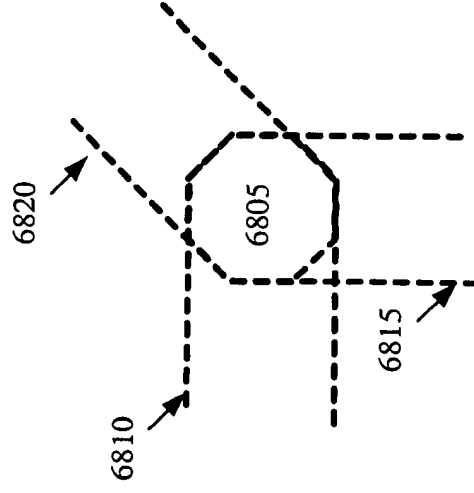


Figure 68

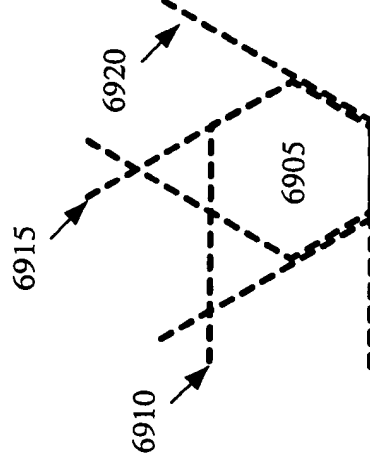
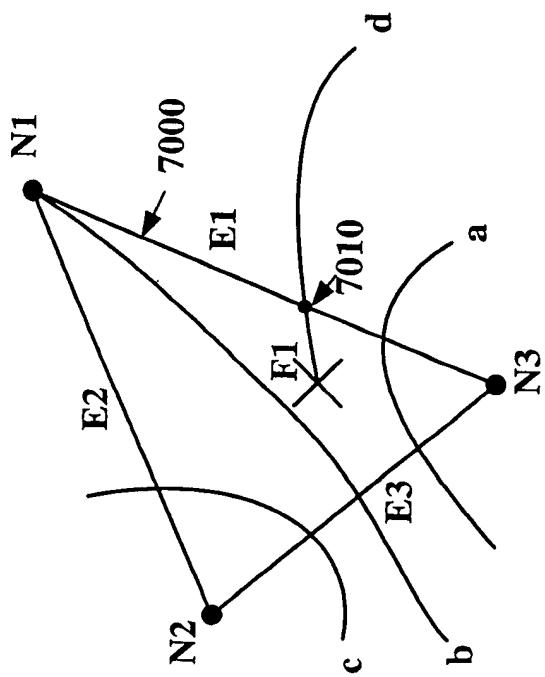
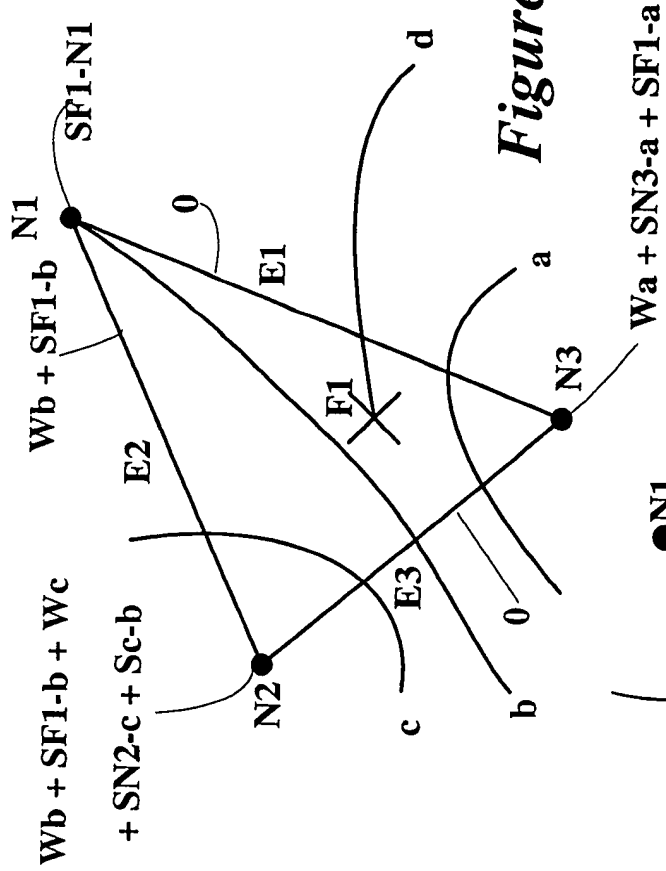


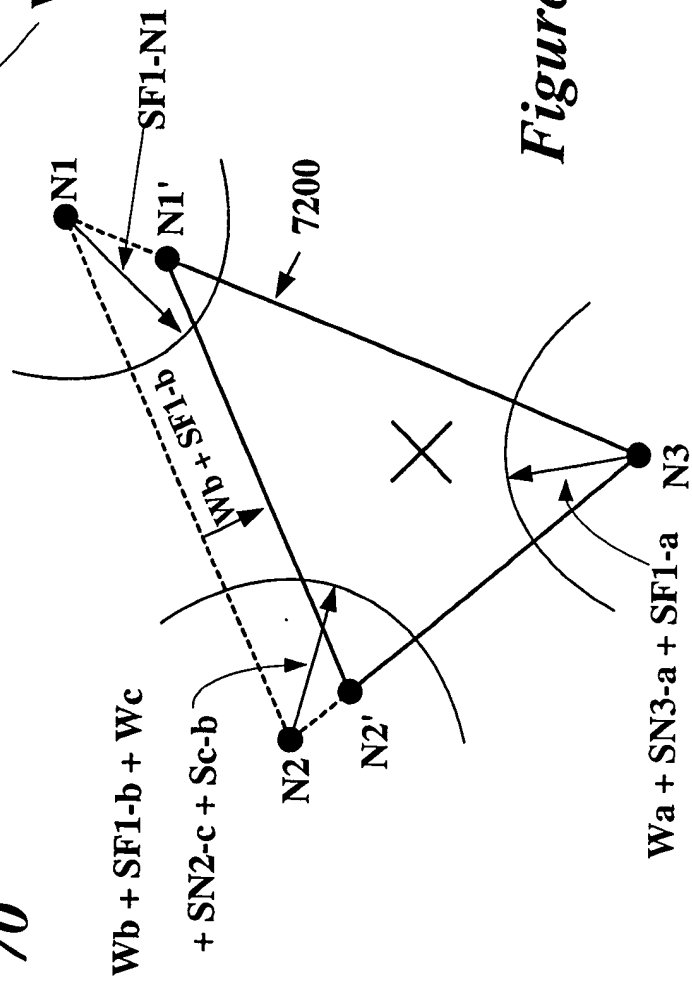
Figure 69



*Figure 70*



*Figure 71*



*Figure 72*

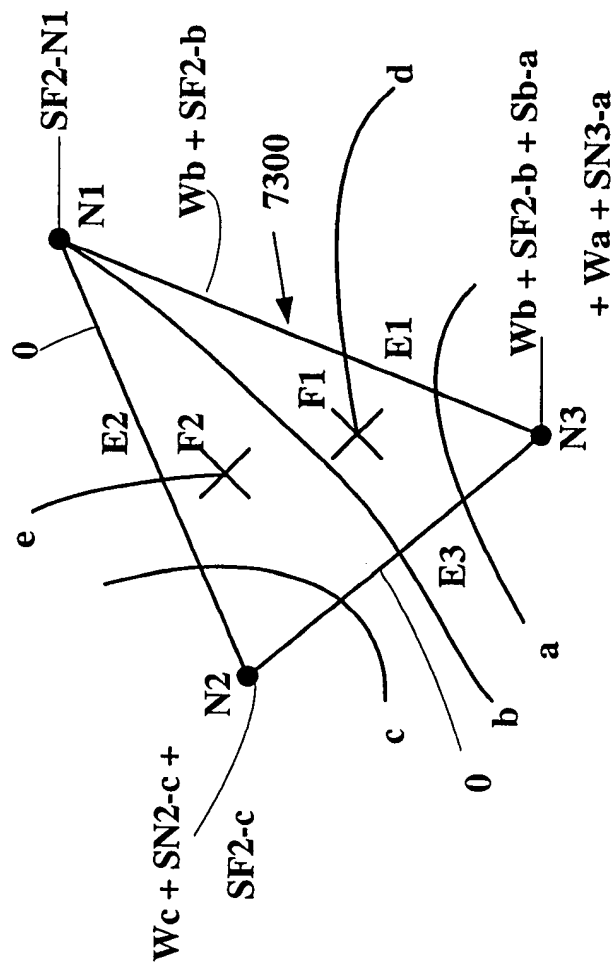


Figure 73

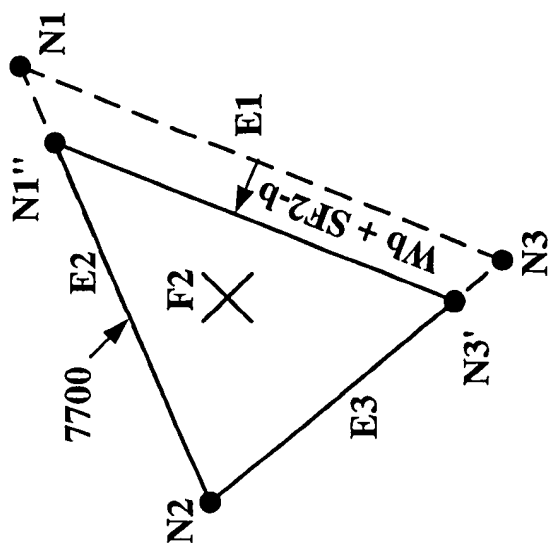


Figure 77

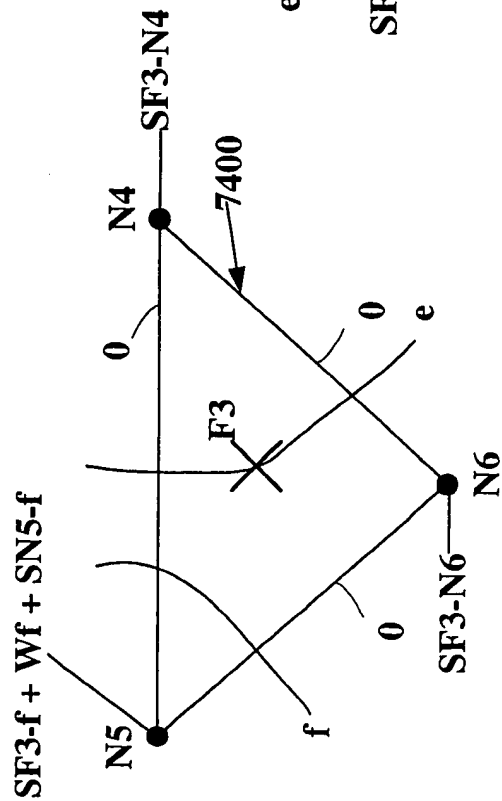


Figure 74

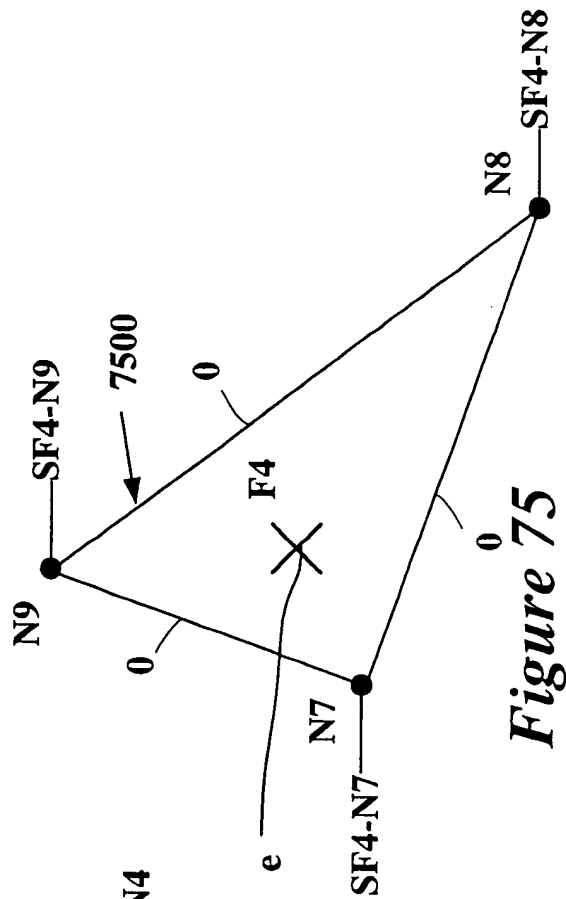


Figure 75

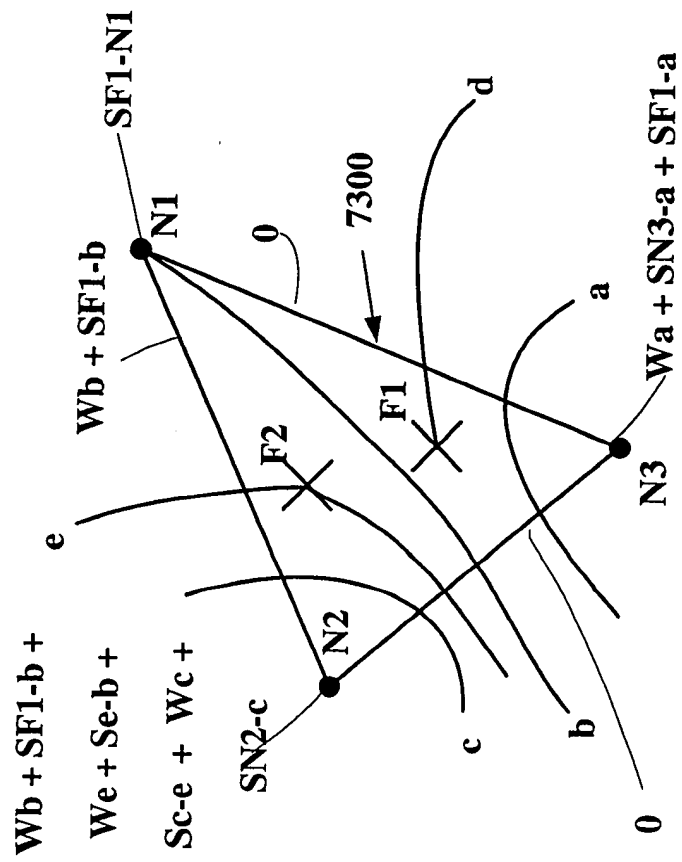


Figure 76

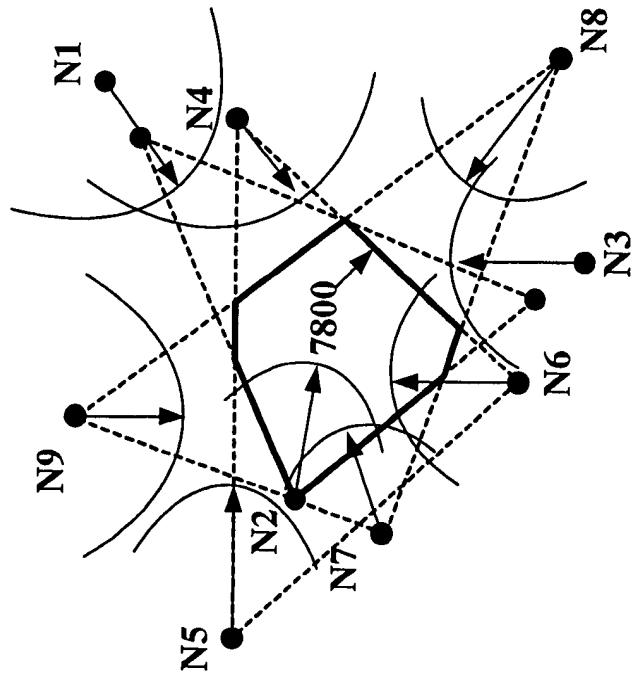


Figure 78





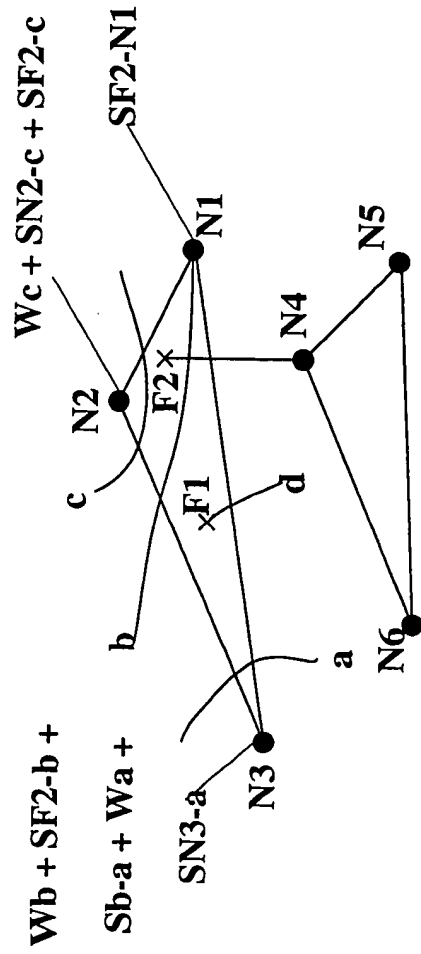


Figure 81

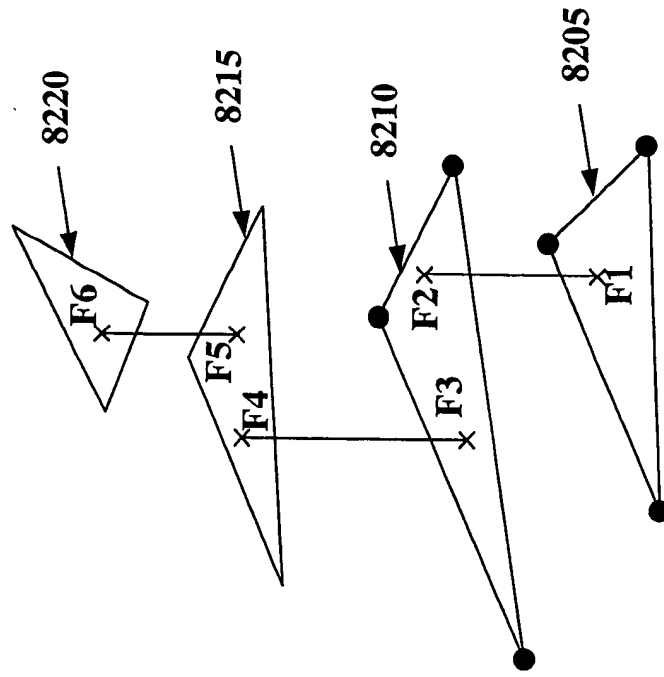
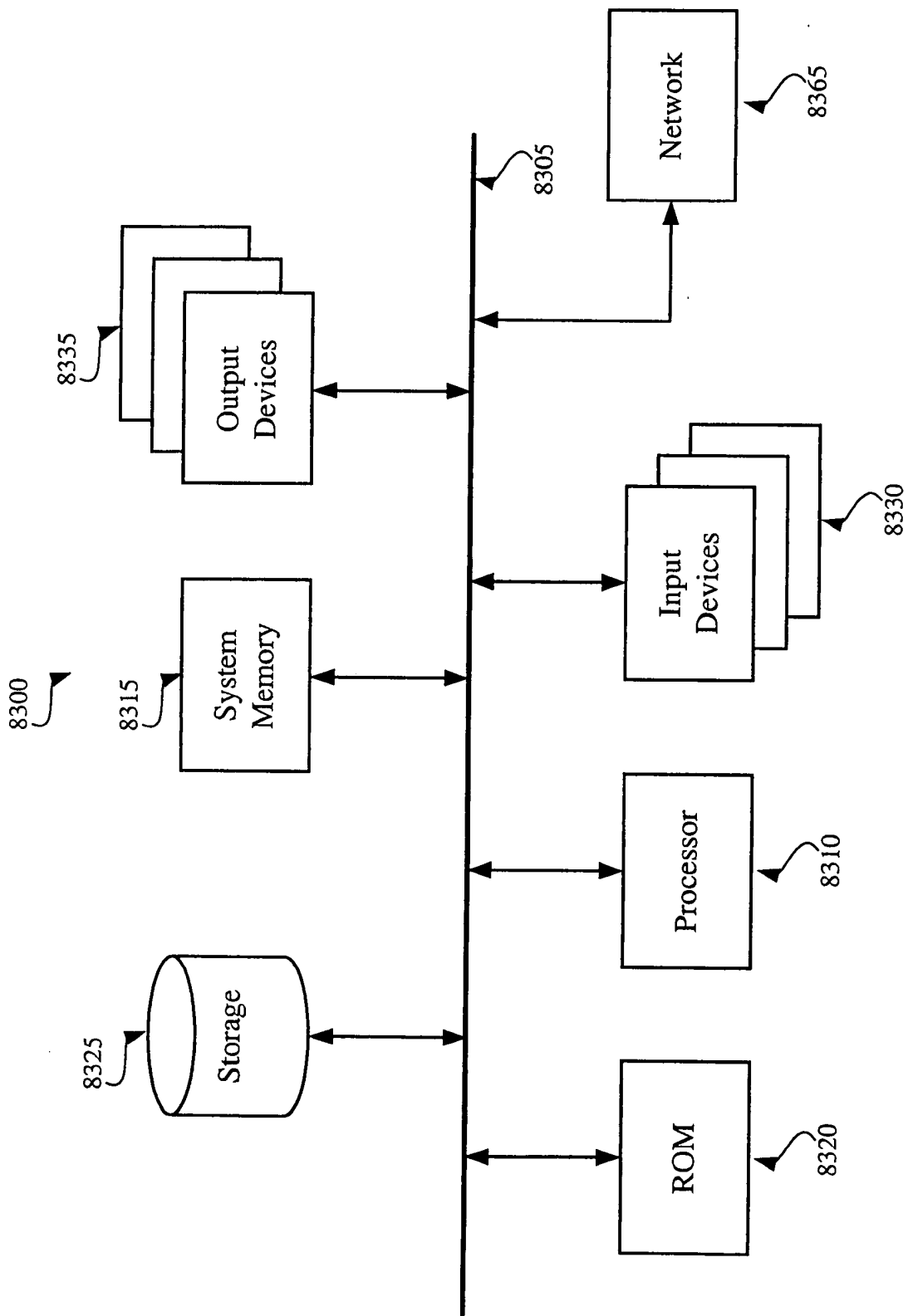


Figure 82



*Figure 83*